COURSE UNIT DESCRIPTION

Course unit title	Code
Applied Anatomy and Fundamentals of Radiology, academic year 2023/2024	**TANA2115**

Lecturer(s)	Department(s)
Coordinating: **Prof. Janina Tutkuvienė** **Others**: Applied Anatomy part: Assoc. prof. Arūnas Barkus, assoc. prof. Eglė Marija Jakimavičienė, assoc. prof. Andrej Suchomlinov, assist. Dainora Bandzevičienė. Fundamentals of Radiology part: Prof. dr. Nomeda Rima Valevičienė, prof. dr. Algirdas Edvardas Tamošiūnas, assoc. prof. Simona Rūta Letautienė, assoc. prof. Jūratė Dementavičienė, assoc. prof. Rūta Briedienė, assoc. prof. Rūta Grigienė, assoc. prof. Birutė Gricienė, assist. dr. Artūras Samuilis, assist. dr. Mindaugas Matačiūnas, assist. dr. Andrius Brazaitis.	Department of Anatomy, Histology and Anthropology, Institute of Biomedical Sciences, Vilnius University Faculty of Medicine, Čiurlionio str. 21, Vilnius Department of Radiology, Nuclear Medicine and Medical Physics, Institute of Biomedical Sciences, Vilnius University Faculty of Medicine, Santariškių str. 2, Vilnius

Cycle	Level of the course unit	Type of the course unit
Integrated studies		Compulsory

Mode of delivery	Period of delivery	Language of instruction
Lectures, practical classes, seminars	Year 2, 4th semester	Lithuanian and English

Prerequisites and corequisites	
Prerequisites: The course of Applied Anatomy and Fundamentals of Radiology may be taken after taking Human Anatomy course	**Corequisites (if any):** none

Number of ECTS credits allocated to the course unit	Total student's workload	Contact hours	Self-study hours
5	133	66	67

Purpose of the course unit Programme competences to be developed
The aim of this course is to present a more detailed knowledge about the structural features of different topographical regions of the human body, relations and interactions of organs and other structures; to introduce students to different radiological methods (conventional radiology (rentgenology) and angiography, densitometry, computed tomography, ultrasound diagnostics, magnetic resonance imaging), diagnostic technology background, indications and contraindications, radiation safety aspects, means of protection against ionizing radiation, exposure optimization techniques, contrast medium and principles of their usage in radiological research. To review the historical aspects of the emergence of radiological methods, perspectives for development. Special attention is paid to the anatomy of living human body – clinical significance of structure and position of structural elements or organs of a certain area. Students are introduced to methods of anatomical examinations of a living person. This course allows students to master organotopic, skeletotopic and sintopic relations between structures of various topographic regions, also cross-sectional anatomy in various planes of the human body, application points and areas of surface anatomy important in clinical practice – in therapy (for percussion, palpation, auscultation), surgery, neurology, anaesthesiology (points of nerve blockades, puncture sites). Students are introduced to radiographic images of the human body.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods

General competencies After the first semester students will be able to:		
Act fairly and according to ethical obligations, be empathic; think critically and self-reflectively; be creative and take the initiative; be goal-oriented; communicate with others.	Lectures, practical classes, and seminars; collaboration-based study strategy (work in pairs or small groups).	Continuous cumulative assessment during the semester.
Make an assessment within the scope of one's competence and, if necessary, ask for help; act in the face of new situations and adapt to them; act independently; solve problems and make decisions; communicate and work in a team with other students; organise and plan.	Lectures, practical classes, and seminars, independent studies; collaboration-based study strategy (work in pairs or small groups).	Continuous cumulative assessment during the semester.
Analyse and synthesize; apply theoretical knowledge in practice.	Practical classes and seminars, independent studies; methods of proactive lecturing (group discussions).	Continuous cumulative assessment during the semester.
Special competencies After the first semester students will be able to:		
Describe body surface anatomy and understand clinical importance of its changes. Find application points of the body surface and describe their clinical importance.	Theoretical material during lectures. Demonstration and study of specimens, anatomical models, schemes and video material. Methods of proactive lecturing (group discussions); collaboration-based study strategy (work in pairs or small groups).	Continuous cumulative assessment during practical classes and seminars.
Describe relations and normal variety of various structures of different topographical regions, and account for the clinical importance of anatomical features and their changes.	Theoretical material during lectures. Demonstration and study of specimens, anatomical models, schemes and video material. Methods of proactive lecturing (group discussions); collaboration-based study strategy (work in pairs or small groups).	Continuous cumulative assessment during practical classes and seminars.
Describe age-related changes and variety of different body parts and organs, as well as their clinical importance.	Theoretical material during lectures. Demonstration and study of specimens, anatomical models, schemes and video material during practical classes and independent studies. Collaboration-based study strategy (work in pairs or small groups).	Continuous cumulative assessment during practical classes and seminars.
Recognize different human body structures of particular topographic areas in specimens, models, radiographic and other human body examination images.	Study of body examination images (radiographic, CT, MRI, ultrasound) during practical classes and independent studies. Collaboration-based study strategy (work in pairs or small groups).	Continuous cumulative assessment during practical classes and seminars.
Ability to describe radiological research methods, know the principles of their operation; application of most recent radiological methods in different clinical fields. Understand reconstruction methods, quality criteria, radiological anatomy, and basic pathological signs of radiological images.	Practical classes and lectures	Continuous cumulative assessment during practical classes and seminars.

Understand contrast medium usage in radiological examinations, computed tomography, magnetic resonance imaging. Know side effects of contrast medium, provide first aid in case of allergic reactions.	Lectures and seminars	Continuous cumulative assessment during practical classes and seminars.
Understand staff and patients' radiation safety principles, know doses of ionizing radiation, units of measurement. Understand application of principles for protection from radiation and optimization of exposure. Ability to use protection against ionizing radiation.	Practical classes and lectures	Continuous cumulative assessment during practical classes and seminars.

Topics	**Contact work hours**							**Time and tasks of self-study**	
	Lectures	Consultations	Seminars	Practical classes	Laboratory work	Practical training	**Total contact hours**	**Independent studies**	**Tasks**
Surface anatomy of upper extremity, application points and areas of structures. Clinical anatomy of the structures of upper extremity. Surface anatomy of lower extremity, application points and areas of structures. Clinical anatomy of the structures of lower extremity.	10		3	3			**16**	**16**	To revise normal anatomy of the upper and lower limbs. To independently study sections, radiographic, CT, MRI images and angiograms of limbs, video material about them. To perform individual and group tasks.
Surface anatomy of trunk, application points and areas. Clinical and age-related anatomy of the structures of back and thoracic organs. Optimal skin sections, points and areas of clinically important blood vessels and nerves, and their applied anatomy. Surface anatomy of abdomen and pelvis, application points and areas. Clinical anatomy of weak points and serous membrane of the abdominal wall. Clinical and age-related anatomy of the abdominal cavity organs. Clinical and age-related anatomy of female and male pelvic organs.	8		3	3			**14**	**14**	To revise normal anatomy of the back, thorax, abdomen and pelvis. To independently study sections, radiographic, CT, MRI, ultrasound images and angiograms of the trunk, video material about it. To perform individual and group tasks.
Surface anatomy of head and neck, application points and areas of structures. Clinical and age-related anatomy of the cerebral part of the head. Clinical and age-related anatomy of the facial part of the head. Clinical and applied anatomy of the nerves of the head. Clinical and age-related anatomy of the organs of neck areas.	6		2	2			**10**	**11**	To revise normal anatomy of the head and neck. To independently study sections, radiographic, CT, MRI, ultrasound images and angiograms of head and neck, video material about them. To perform individual and group tasks.
Introduction to the radiology. The history of radiology, x-ray discovery, types of radiation. History of radiology in Lithuania and abroad, future perspectives. Information technologies in radiology.			2				**2**	**2**	To prepare for the practical classes. To perform individual and group tasks.

Conventional radiology. Methods of conventional radiology (roentgenology) – roentgenoscopy (fluoroscopy), roentgenography; basic principles, advantages and disadvantages, analogical and digital imaging (X-ray diagnostics), quality criteria, etc.,	1			2			**3**	**3**	To prepare for the practical classes. To perform individual and group tasks.
Means and methods for protection against ionizing radiation. Units of measurement for ionizing radiation. Principles of radiation safety, exposure optimization.	1		2	2			**5**	**5**	To prepare for the practical classes. To perform individual and group tasks.
Contrast medium and their usage in X-ray diagnostics.	1						**1**	**1**	To prepare for the practical classes. To perform individual and group tasks.
Sonography. Theoretical principles of vibrations and waves. Propagation of acoustic waves in fluids and biological tissues. Generation and registration of ultrasonic waves. Biological effects of ultrasound: cavitation and thermal effect. Diagnostic ultrasound systems. Imaging modes. Optimisation and management of machines' control parameters. Future perspectives and recent advancement in ultrasonic methods in medicine.	1			2			**3**	**3**	To prepare for the practical classes and seminar. To perform individual and group tasks.
Principles of operation of magnetic resonance imaging, main indications and contraindications. Sequences selected during examination. Classification of MRI tomographs, recent sequences and future perspectives.	2		2	2			**6**	**6**	To prepare for the practical classes. To perform individual and group tasks. To independently learn to distinguish between T1, T2, and dark liquid sequences.
Principles of computed tomography operation, image analysis. Principles of sequential, spiral, single-slice and multislice computed tomography, design of different generations of machines, main indications and contraindications. Main imaging parameters, CT workflow and personnel.	2		2	2			**6**	**6**	To prepare for the practical classes. To perform individual and group tasks.
Total	**32**		**16**	**18**			**66**	**67**	

Assessment strategy	**Weight (%)**	**Assessment period**	**Assessment criteria**
Work during lectures, practical classes and seminars. **Four cumulative colloquia are organized:** three – of Applied Anatomy, one – Fundamentals of Radiology. At the end of the course, the final cumulative score of this joint subject is calculated.		During semester	Attendance of more than 80 % of seminars and practicals of Applied Anatomy part and Fundamentals of Radiology part is required (i.e. up to 20 % can be missed with a justifiable reason). Active attendance of lectures is welcomed, as well as performance of additional tasks given in lectures or seminars. During the semester, three cumulative colloquia of Applied Anatomy from three different topographical regions (Limbs, Trunk, and Head and Neck) and one major colloquium of Fundamentals of Radiology are organized. If the student does not pass the colloquia, they must be passed next time – an additional opportunity is given to eliminate the debt. Theoretical and practical knowledge is assessed during the colloquia (tests) of Applied Anatomy and Fundamentals of Radiology. Tests are taken in computer classrooms or remotely.

Three cumulative colloquia of Applied Anatomy from three different topographical regions (Limbs, Trunk, and Head and Neck)	60	During semester	The cumulative part of the colloquia of Applied Anatomy (60.0 %) is assessed taking into account the proportion of the studies of the three topographic areas of the body: maximal accumulated part during the colloquium on Limbs compounds 24.0 % (cut-off value to pass the colloquium – 12.0 %); Trunk – 20.0 % (cut-off value to pass – 10.0 %); Head and neck – 16.0 % (cut-off value to pass – 8.0 %).
One large cumulative colloquium of Fundamentals of Radiology	40	During semester	One major colloquium of Fundamentals of Radiology part compounds 40.0 % of the final cumulative assessment (cut-off value to pass – 20.0 %). The joint subject of Applied Anatomy and Fundamentals of Radiology is credited at the end of the course, if the student meets the attendance requirements and passes four colloquia. Cumulative score (final grade) of the joint subject is determined according to the scheme as follows: 10 – if the total score is ≥90.0 % 9 – if the total score is ≥83.0 % 8 – if the total score is ≥75.0 % 7 – if the total score is ≥65.0 % 6 – if the total score is ≥55.0 % 5 – if the total score is ≥50.0 % 4 – if the total score is <50.0 % (not passed)

Author	**Year of publication**	**Title**	**No of periodical or vol. of publication**	**Publication place and publisher or Internet link**
Required reading				
1. (Moore K.L.), Dalley A.F., Agur M.R.	2010-2022	Moore's Clinically Oriented Anatomy	6- 9th ed.	Lippincott Williams and Wilkins
2. Standring S. (Ed.)	2008-2021	Gray's Anatomy: The anatomical basis of clinical practice	40-42nd ed.	Churchill Livingstone
3. Netter F. H.	2010-2022	Netter Atlas of Human Anatomy	5-8th ed.	Elsevier
4. Möller B., Reif E.	2010	Pocket Atlas of Radiographic Anatomy	3rd ed.	Thieme
5. Möller B., Reif E.	2006-2017	Pocket Atlas of Sectional Anatomy, CT and MRI imaging	2-4th ed. Vol.1,2,3	Thieme
6. William Herring	2019-2023	Learning Radiology: Recognizing the basics	4th-5th ed.	Elsevier
Recommended reading				
1. (Moore K.L.), Dalley A.F., Agur M.R.	2011-2023	(Moore's) Essential Clinical Anatomy	4-7th ed.	Lippincott Williams and Wilkins
2. Lampignano J., Kendrick L.E.	2013-2020	Bontrager's Handbook of Radiographic Positioning and Techniques	8-10th ed.	Mosby
3. Goldberg S., Ouellette H.	2010-2016	Clinical Anatomy Made Ridiculously Simple (WIN/MAC)	4th ed.	Medmaster
4. Dixon A.K., Bowden D.J., Logan B.M., Ellis H.	2017	Human Sectional Anatomy: Pocket atlas of body sections, CT and MRI images	4th ed.	CRC Press
5. Zaheer, A., Raman S.P., Rosado-de-Christenson M.L., Martinez-Jimenez S., Garrana S.H., Fananapazir G., Rogers D., Foster B.R.	2016-2023	Imaging Anatomy: Chest, Abdomen, Pelvis	2nd-3rd ed.	Elsevier

6. Dugani S., Alfonsi J.E., Agur A.M.R., Dalley A.F.	2016	Clinical Anatomy Cases: An Integrated Approach with Physical Examination and Medical Imaging	1st ed.	LWW

Links to recommended el. books and other links:		
Netter's Concise Radiologic Anatomy	2nd ed.	https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20170047572
Netter's Clinical Anatomy	5th ed.	https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20200019894
Netter Atlas of Human Anatomy	8th ed.	https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20180044345
Gray's Anatomy	42nd ed.	https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20170037291
Gray's Anatomy for Students	5th ed.	https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20210023117
McMinn and Abrahams' Clinical Atlas of Human Anatomy	8th ed.	https://www.clinicalkey.com/#!/browse/book/3-s2.0-C20160031704
Atlas of Peripheral Nerve Blocks and Anatomy for Orthopaedic Anesthesia	Open source	https://archive.org/details/AtlasOfPeripheralNerveBlocksAndAnatomyForOrthopaedicAnesthesia
		http://radiopaedia.org/
		http://www.radiologyassistant.nl/
Links to el. publications (available in MF):		https://www.clinicalkey.com/#!/browse/books/%7B%22indexOverride%22:%22GLOBAL%22,%22query%22:%22anatomy%22%7D