Name of the course	**Nuclear medicine**			***Code***	MSE401
Type of study program:	Integrated university study program, Medicine			***Year of study***	4
Credits (ECTS):	1.5	***Semester:***	VII	***Number of hours per semester (l+s+e)***	30 (10+10+10)
Status of the course:	obligatory	***Preconditions:***	Passed 3rd study exam's	***Comparative conditions:***	/
Access to course:	Fourth year students			***Hours of instructions:***	according to schedule

Course teacher:	Assistant prof. Ivan Jurić, MD, PhD
Consultations:	As agreed with students
E-mail address and phone number:	vnjuric5@gmail.com ; +387 36 341 972 Institute of Nuclear medicine
Associate teachers:	Associate prof. Ante Punda, MD, PhD Assistant prof. Ana Barić, MD, PhD Ass Damir Rozić, dr. med Ivica Lovrić, chemical engineer.
Consultations:	As agreed with students
E-mail address and phone number	vnjuric5@gmail.com ; +387 36 341 972 d_rozic@yahoo.com

The aims of the course:	Students should acquire essential knowledge of nuclear medicine, principals of fundamental knowledge of radiation and nuclear medicine procedures, radiation protection including internal dosimetry for patients. The aim of this course is to provide students with knowledge on basic rules for application of open sources of ionizing radiation and diagnostic and therapeutic options of radioactive isotopes.
Learning outcomes (general and specific competences):	Students who complete this course successfully will know and be able to: General: • Plan independent learning throughout the study by critically and self-critically questioning scientific truths. • Demonstrate skills and personal qualities (present yourself both physically and verbally; Ability to be persuasive wheninteracting with colleagues). Specific: • Explain basic physics of Nuclear medicine • Explain basic principles of radiobiology • Explain principles of radiation protection • Interpretate nuclear medicine findings (scintigram) The final grade may be a result of several intermediate results. Continuous assessment can take various forms: colloquiums, self quiz at seminars and other forms of active learning during practicals. Every course unit is concluded with either a written or written-oral examination. Study results are evaluated by the teacher who is the head of the course or by the commission of experts of a special range
Course content (Syllabus):	Lectures:10; Seminars:10; Practices:10.

Format of instruction (mark in bold)	**Lectures**	**Exercises**	**Seminars**	Independent assignments
	Consultations	Work with mentor	Field work	Other
	Remark: Course starts with lectures followed by seminars and practices. At seminars group of students gets tasks to be resolved At practice students are actively involved in activities of preparing of radiopharmaceuticals, work with gamma camera and computer connected with.			

Student responsibilities	Final exam; Colloquium at seminars; Attendance activity ;Students will be graded based following: • Attendance activity (seminars; practice) • Preparation of course subjects at seminars • By Written exam • By Oral exam			
Screening student work (mark in bold)	**Class attendance**	**Class participations**	Seminars essay	Practical training
	Oral exam	**Written exam**	**Continuous assessment**	Essay

Detailed evaluation within a European system of points

STUDENTS RESPONSIBILITIES:	**HOURS**	**PROPORTIONS OF ECTS CREDITS**	**PROPORTIONS OF GRADE**
Class attendance and participations	30	1	10%
Written exam	10	0.3	70%
Oral (practical) exam	5	0.2	20%
Total	**45**	**1.5**	**100%**

Further Clarification:
The examinations: Written exam; Oral (practical) exam.

Written exam (70% of total grade)
Requirements for taking written exam: regularity of teaching attendance, seminars and practices. A candidate must pass written examinations for admission to the oral examinations (scintigraphic interpretation).
Validation of a written examination lasts for one year (current academic year).Written exam evaluation criteria: score of 55% is necessary in order to pass the exam.

Seminars work (10% of total grade)
Each seminar followed by oral evaluation and discussion about scintigraphic findings.

Oral (practical) exam (20% of total grade)
Oral (practical) exam consists of interpreting 30 different types of scintigrams. Students have to recognize some characteristic features (characteristic patterns of uptake) which can raise thesuspicion and help in reaching a proper diagnosis.

Final score:
Written exam (70%) + Seminars (10%) + Oral (practical) exam (20%)

The final assessment is carried out according to the Regulation of Studies of the University of Mostar and applies to all study groups. According to the regulations on studying final grade is obtained as follows:
A = 91-100% 5 (excellent)
B = 79 to 90% 4 (very good)
C = 67 to 78% 3 (good)
D = 55 to 66% 2 (satisfactory)
F = 0 to 54% 1 (fail)

Required literature:	**European Nuclear Medicine Guide** A joint publication by EANM and UEMS/EBNM Edited by: Roland Hustinx and Kristoff Muylle https://www.nucmed-guide.app/#!/home
Optional literature:	Key word Searching
Additional information about the course	Quality of Teaching is assessed by student surveys, student and teacher course evaluation, evaluation of succeeding in exams, Report of Quality Teaching Staff and self-evaluation and non-institution evaluation (external quality review).

Annexes: calendar classes

The number of teaching units	**TOPICS AND LITERATURE**
I.	Title: History of Nuclear medicine; Nuclear-medicine Physics; Basic Physics.
	Short description: Atomic and Nuclear Structure. Isotopes. Modes of Radioactive Decay. Radioactivity of atomic nuclei and electron layer. Interactions of Radiation with Matter. Attenuation of the radiationsource, Half-life of the radionuclide. Radiation Safety
	Literature: Mandatory and optional
II.	Title: Principles of Nuclear medicine
	Short description: Radiation Detector Performance: Ionization Detectors, Scintillation Detectors, Wellcounter's, scintillation probes and Gamma Cameras. Collimatores. Scintigraphy. Scintigraphic hot and cold spots. Static and dynamic study. Computer in Nuclear medicine. Single Photon Emission Computed Tomography (SPECT); Positron Emission Tomography(PET); Image fusion.
	Literature: Mandatory and optional
III.	Title: Thyroid disease diagnosis
	Short description: Radionuclide diagnosis of thyroid disease, thyroid scan, in vitro tests, Thyroid ultrasound and Fine needle aspiration. Imaging of thyroid with RTG, CT and MR.
	Literature: Mandatory and optional
IV.	Title: Hypothyroidism and Hyperthyroidism
	Short description: Diffuse toxic goiter, Toxic thyroid adenoma and Toxic multinodular goiter. Jod-basedow. Thyrotoxicosis without hyperthyroidism. Thyroiditis: acute and subacute thyroiditis, silent thyroiditis, chronic autoimmune thyroiditis, fibrous thyroiditis. Thyroid dysfunction induced by amiodarone and interferon therapy
	Literature:: Mandatory and optional
V.	Title: Hypothyroidism
	Short description: Primary, secondary and tertiary. Chronic thyroiditis and Hypothyroidism. Post-ablative hypothyroidism. Latent hypothyroidism. Hypothyroidism in pregnancy.
	Literature: Mandatory and optional
VI.	Title: Goiters
	Short description: Diffuse and multinodular goiter. Functional thyroid status. The relationships with surrounding structures. Endemic goiter
	Literature: Mandatory and optional
VII.	Title: Thyroid tumors/benign and malignant/
	Short description: Differentiated thyroid carcinomas. Well-differentiated thyroid carcinoma, Poorly differentiated thyroid cancer and non-differentiated thyroid carcinoma. Thyroid microcarcinoma. Protocol for the Examination of Specimens From Patients With Carcinomas of the Thyroid Gland. Treatment of patients with thyroid carcinoma. Radioiodine ablation. Follow-up of differentiated thyroid carcinoma.
	Literature: Mandatory and optional
VIII.	Title: Nuclear cardiology; nuclear pulmonology
	Short description: Radiocardiography and Cardiac ventriculography. Scintigraphy myocardial infarction. Scintigraphy myocardial metabolis and Scintigraphy *of* myocardial innervation. Radionuclide phlebography. Scintigraphic imaging for detection and localization of deep vein thrombosis. Angioscintigraphy. Blood pool scintigraphy. Ventilation-perfusion scintigraphy.
	Literature: Mandatory and optional
IX.	Title: Nuclear medicine in neurology and psychiatry
	Radiopharmaceuticals. Brain scintigraphy. Brain death. Radionuclide cisternography, Diagnosis of hydrocephalus, Radionuclide cisternography in diagnosis and management of cerebrospinal fluid leaks. Diagnosis of Neurodegenerative disease. Brain SPECT imaging.
	Literature:: Mandatory and optional
X.	Title: Scintigraphic Detection of Infection and Inflammation and Tumor scintigraphy

	Short description: Gallium-67 (^{67}Ga) scintigraphy, J-131, J-131-MIBG. Immunoscintigraphy. Somatostatin receptor scintigraphy. Tumor markers. White blood cell scintigraphy, antigranulocyte antibodies scintigraphy, colloid scintigraphy, difosfates scintigraphy, FDG.
	Literature: Mandatory and optional
XI.	Title: Radiation protection
	Short description: Basic principles of dosimetry and radiation risk. Dosimetric units, Absorbed dose calculation. Effective and Equivalent dose. Basic principles of Radiation risk in Nuclear medicine. Biological effects of radiation on mammals. The whole body measurements of radioactivity. Health effects of radiation exposure: acute effects, Local radiation injury, Acute radiation syndrome, Chronic radiation syndrome. Medical managementin case of high radiation exposure or contamination. Protection individuals exposed to source of ionizing radiation. Radiation safety regulations and standards in Nuclear medicine.
	Literature: Mandatory and optional
XI.	Title: Gastroenterology and Hematology
	Short description: Hepatobiliary scintigraphy; Liver and spleen coloid scintigraphy; Liver hemangioma; Spleen scintigraphy; Gastrointestinal Bleeding Scintigraphy; Meckel's Diverticulum. Scintigraphy; Other examinations in nuclear gastroenterology; Hematology; Blood volume; The measurement of red blood cell survival; Leucocytes and platelets kinetics; Ferokinetics; Schillingo test Vitamin B12 Deficiency; Radionuclide therapy; Radioimmunotherapy of B cell non-Hodgkin's lymphoma. Radio-phosphorus therapy; Metaiodobenzylguanidine (I-131 MIBG) therapy; Radioimmunotherapy; Intracavitary radiation therapy;Palliative radiation therapy for bones; Other examinations; Lacrimal scintigraphy; Salivary gland scintigraphy; Lymphoscintigraphy.
	Literature:: Mandatory and optional