Program	Level of studies		**First cycle**	
	Program name		**Physics**	
Course name	**MEDICAL RADIATION PHYSICS I**			
Course ID	Semester	Course status	ECTS credits	L+E
PAP7531	**VII**	**ELECTIVE**	**5**	**2+2**
Lecturer	**Doc. dr. Adnan Beganović**			
Aims and intended learning outcomes	Aim: Adopt basic knowledge in medical radiation physics and radiation protection. Outcomes: to understand the basics of dosimetry of ionizing radiation and radiation biology; master and understand the basic methods and techniques used in modern radiotherapy, diagnostic radiology and nuclear medicine, and apply them in medical practice; understand the basic principles of radiation protection, and apply them consistently in medical practice.			

Course content

1. Introduction: The subject of study and the role of medical radiation physics in modern medicine; Exercises.
2. Interaction of ionizing radiation with matter: The charged particles; Stopping power for heavy charged particles; Necessary corrections for electrons and positrons; The theory of multiple collisions and the application of the transport of charged particles; Bremsstrahlung and emission stopping power; Energy and angular distribution of X-ray radiation formed on a thin and thick target; Deposit of energy for heavy charged particles and electrons; Absorption of monoenrgetic electron beam; Variations in energy and angular distribution of electrons with depth; Calculation of medium and most probable energy; Photons; Energy balance in the case of photoelectric effect, coherent scattering, incoherent scattering and production of electron-positron pairs on the nucleus and in the electron field; Variations of the effective cross-section depending on energy and atomic number; Energy and angular distribution of secondary photons and electrons; Attenuation curves; Half-value layer (HVL) and the mean free path; Neutrons; Absorption of neutrons; Q-relation; Neutron resonance; Deposit of neutron energy depending on depth; Exercises
3. Basics of the dosimetry of ionizing radiation: The subject of the study is the dosimetry of ionizing radiation and the dosimetric quantities; Measurement units in the dosimetry; Effective atomic number; The concept of KERMA and absorbed dose; Electronic equilibrium; Exposure; Finding absorbed dose in free space (Bragg-Gray's theory); Absorbed dose in the phantom; A relationship that connects the energy flux and exposure; Conversion of exposure to absorbed dose; Exercises
4. High-energy machines for the production of ionizing radiation: Introduction; Medical linear accelerator; Isotope machines; Cyclotron; High-energy particles in radiotherapy; Exercises.
5. Radiation biology: Cell structure; Genetic code; Chromosomes and cell division; The effect of radiation on the cell; Deterministic and stochastic effects; Mutations; Survival curve; Whole body irradiation; LD_{50} and LD_{100}; Acute radiation syndrome; Radiation risk and its evaluation; Exercise.

Student workload (hours)		Grading	
Lectures and Exercises	60	Assessment method	Points
Exam preparation	50	Midterm	45
Other	5	Final	45
Total	125	Activity	10
		Total	100

Literature

1. Dance DR, Christofides S, Maidment ADA, McLean ID, Ng KH, editors. Diagnostic Radiology Physics: A Handbook for Teachers and Students. Vienna, Austria: IAEA; 2014.
2. Pdgoršak EB, editor. Review of Radiation Oncology Physics: A Handbook for Teachers and Students. Vienna, Austria: IAEA; 2005.
3. Bailey DL, Humm JL, Todd-Pokropek A, van Aswegen A, editors. Nuclear Medicine Physics: A Handbook for Teachers and Students. Vienna, Austria: IAEA; 2014.
4. Johns HE, Cunningham JR. The Physics of Radiology. 4th ed. Springfield, IL: Charles C Thomas; 1983.

Remarks

Exercises are performed at the Clinical Centre of Sarajevo University.