Study program	Level of studies	**Second cycle**
	Study program name	**Physics**
Course name	**PHYSICS OF IONIZING RADIATION II**	

Course ID	Semester	Course status	ECTS credits	L+E
PAP8621	**IV**	**ELECTIVE**	**6**	**2+2**

Lecturer	
Aims and intended learning outcomes	The aim of this course is to give students basic knowledge of the process of ionizing radiation interaction with matter and the detection of ionizing radiation. After completing the course, students should understand the basics of the processes that occur in the interaction of ionizing radiation with matter and solve related problems. Student should understand the principles of the detection of ionizing radiation.

Course content

Interaction of photons with matter: Linear attenuation coefficient and exponential attenuation. HVL. Mass, electron and atomic attenuation coefficients. Transfer and absorption of energy. Energy transfer and energy absorption coefficient. Coherent and incoherent scattering. Photoelectric effect. Dependance on atomic number and photon energy. Thomson (classic) scattering. Rayleigh (coherent) scattering. Compton (incoherent) scattering. The probability of Compoton collisions (Klein-Nishina coefficient). Production of electron-positron pairs. Energy distribution of electrons and positrons formed in the pair production. Total attenuation coefficient. Total energy transfer and energy absorption coefficient. Multiple processes, Monte Carlo simulations.

Interaction of charged particles with matter: Interaction of heavy charged particles with matter. Stopping power. Bragg peak. The interaction of the electron with matter. Energy loss by radiation. Mean stopping power. Linear Energy Transfer (LET). Monte Carlo simulations. Rang (range) of particles, its dependence on energy, charge, mass. Brag - Kleeman's rule. General properties and principles of ionizing radiation detectors operation. Gas detectors. Liquid detectors. Solid-state detectors. Spectrometers of ionizing radiation. Passage of neutrons through matter.

Student workload (hours)		Grading	
Lectures and Exercises	60	Assessment method	Points
Exam preparation	65	Midterm exams	40
Assignments	25	Seminar	20
Total	150	Final exam	40
		Total	100

Literature

1. D. Samek,L. Saračević , A. Lagumdžija, Fizika jonizirajućih zračenja, Veterinarski fakultet Univerziteta u Sarajevu, 2010
2. A. Lagumdžija, D. Samek, R. Musemić, Fizika jonizirajućih zračenja u primjeni, PMF Univerziteta u Sarajevu 2010
3. Corresponding material from the web-site "e-nastava" and notes from the lectures.

Additional readings:

1. H. Johns, J. Cunningham, The physics of radiology, Charles C Thomas Publisher, Springfield, Illinois 1983
2. E. B. Podgorsak, Radiation oncology physics, IAEA 2005
3. S. N. Ahmed, Physics & engineering of radiation detection, 2nd edition, Elsevier 2015

Remarks

A student must win a minimum of 22 points on partial exams in order to enter the final exam. To successfully pass, at the final exam the student must score at least 22 points, and the total score must be at least 55 points.