

Study program	Level of studies		Second cycle	
	Study program name		Physics Education	
Course name	PHYSICS OF THE HUMAN BODY			
Course ID	Semester	Course status	ECTS credits	L+E
PHY9511	II	ELECTIVE	6	3+1
Instructor				
Aims and expected learning outcomes	The goal of this course is to provide an introduction to the physics of the human body. The laws of physics are used to explain some bodily functions such as the mechanics of muscles, fluid mechanics of blood, hearing and acoustic properties of the ears, heat and energy, vision optics, and electrical signalling.			
	At the end of the course the student should be able to: -explain the biomechanics of the body; -use the principles of physics to explain the functioning of cardiovascular and pulmonary systems; -describe the electrical conduction system of the nerves, the brain and the heart; -apply the principles of physics to describe the functions of the visual and auditory system; -solve basic conceptual and numerical problems related to the human body.			
Course content				
Terminology, modeling, and measurement. Mechanics. Muscle and Forces. Categories of forces. Some effects of gravity on the body. Electrical forces in the body. Frictional forces. Newton's laws of motion. Physiological applications of Newton's laws. Torque and equilibrium. Classes of levers and physiological applications. Energy, heat, work, and power the body. Transport of energy and matter. Heat and laws of thermodynamics. Heat losses from the body. Membranes in the living organisms. Diffusion and osmosis. Physics of the lungs and breathing. The ideal gas laws. The basic parameters of the respiratory system at the rest. Pressure-volume relationship of the air in the lungs. Physics of the alveoli. The breathing mechanism. The work of breathing. Fluids. Flow of an ideal dynamic fluid. Viscosity. Physics of the cardiovascular system. Work done by the heart. Basic issues in blood flow. Blood pressure and its measurement. Vibrations and waves. Sound and speech. Sound intensity and sound intensity level. Physics of the ear and hearing. The hearing range of the human ear. Force and pressure amplification in the middle ear. Electromagnetism. Electricity within the body. The nerves as an electrical system. Electrochemical processes in nerves. The flow of charges. Stimulated nerve impulses. Electrocardiography. Physics of the eyes and vision. Ray optics. Applications in optometry and ophthalmology. The Eye. Defects of the eye. Wave optics. Diffraction effects on the eye.				
Student workload (hours)		Grading		
Lectures and Exercises	60	Assessment method	Points	
Exam preparation	90	Course Test	50	
Total	150	Final Exam	50	
		Total	100	
Literature				
1. Lecture Notes. 2. S. Stanković, Fizika ljudskog organizma, prvo izdanje, PMF, Novi Sad, 2006. 3. J. R. Cameron, J. G. Skofronick, R. M. Grant, Physics of the Body, revised second ed., Medical Physics Publishing, Madison Wisconsin, 2017. 4. M. Zinke-Allmang et al., Physics for the life sciences, third ed., Nelson education, Toronto, 2017. 5. P. Davidovits, Physics in biology and medicine, fourth ed., Academic Press, London, 2013. 6. K. Franklin et al., Introduction to Biological Physics for the health and life sciences, first ed., Wiley, New York, 2010.				
Remarks				
Continuous knowledge and skills assessment will be carried out through midterm exams (written tests). Final examination can also be oral exam. The successful completion of the course implies achieving at least 55% of the total number of points in both the partial and final exam.				