Course Title	**Biophysics and Radiology**				
Course Code	**NURS107**				
Course Type	Compulsory				
Level	Bachelor (Level 1)				
Year / Semester	1st / Fall				
Instructor's Name	Dr. Yiannis Parpottas				
ECTS	4	Lectures / week	3	Laboratories/week	
Course Purpose	The aim of this course is to introduce the students to the physical principles required by the contemporary scientific approach for the understanding of (a) the biophysical changes and phenomena that affect the function of biological systems, (b) the physical principle of functioning and precautions for the most commonly used medical devices and modalities. This course also provides to students the knowledge for radiation protection in their daily practice.				
Learning Outcomes	By the end of this course, students should be able to: - Describe the optics phenomena of refraction and total reflection, explain the mechanism of vision, the refractive anomalies of vision and their corrective lenses, and the physical principles of medical devices in ophthalmology. - Describe the human motion and balance, recognize and explain the forces (e.g. friction at the human joints) and torques (e.g. levers of the body and of medical instruments) exerted to or from the body. - Define the concepts of heat and temperature, explain the heat balance - heat transfer - body temperature, the phenomena of expansion and contraction in terms of atoms thermal motion, explain the physical principle of the medical thermometer, the temperature scales, and recognize applications of thermal radiation in medicine (e.g. thermography). - Describe the wave motion, the wave phenomena (reflection, refraction, and diffraction), the characteristics of sound waves, the hearing mechanism, the mechanism of ultrasound (production-propagation-detection), explain the Doppler effect, illustrate knowledge of the sound biological effects and the interaction mechanism of ultrasound with tissues, and recognize ultrasound applications in medicine. - Identify the basic concepts in electricity and magnetism used in medicine and biomedical technology, explain the biological effects of electricity on the human body, recognize electromagnetic applications in medicine and electric hazards, and describe the safety rules				

	necessary to apply in hospitals. - Describe the atomic phenomena of excitation, de-excitation and ionization, explain the physical principles, characteristics and applications of LASER and X-ray in medicine, recognize their biological effects and describe precautions and safety rules necessary to apply in hospitals. - Describe the types of radiation emitted from the nucleus, explain the concept of half-life of a radioactive nucleus, recognize the biological effects of ionizing radiation, illustrate knowledge of allowed doses in human organs, describe the safety rules necessary to apply in hospitals for radiation protection, and illustrate knowledge of external (radiosources) and internal (radiopharmaceuticals) use of radiation in nuclear medicine for diagnosis and therapy. - Search, write and present the physical principle of functioning of a medical device / modality and the necessary precautions for use.		
Prerequisites	None	Corequisites	None
Course Content	- Optics: optics phenomena, mechanism of vision, refractive anomalies of vision and corrective lenses, medical devices in ophthalmology. - Mechanics: motion and balance of the human body, forces and torques exerted to or from the human body. - Heat: heat and temperature, heat balance, heat transfer, body temperature, thermometers, temperature scales, expansion, and contraction in terms of the thermal motion of atoms, applications of thermal radiation in medicine (e.g. thermography). - Waves: wave motion, wave phenomena (reflection, refraction, diffraction), sound waves, hearing mechanism, biological effects of sound, Doppler effect, ultrasound mechanism, ultrasound interactions with tissues and applications in medicine. - Electromagnetism: applications of electricity and magnetism in medicine and biomedical technology, biological effects, electric hazards, precautions and safety rules in hospitals. - Atomic physics: atom structure, atomic physics phenomena (excitation, de-excitation, ionization), LASER and X rays (mechanism, characteristics, biological effects, precautions in hospitals) - Nuclear Physics: nucleus structure, type of radiation, half-life, ionizing radiation (biological effects, dosimetry, detectors, radiation protection), nuclear medicine (radiosources and radiopharmaceuticals). - Case study: Search, write and present (interview presentation or computer presentation) about topics related to medical devices / equipment (physical principle of functioning, proper usage, precautions).		

Teaching Methodology	Lectures are delivered to the students by means of computer presentations including images, simulations, and videos. Lecture notes and presentations are available through the website of the course (e-learning) to be used in combination with the textbooks. Lectures begin with real-life observations, challenging the students for explanations (discussions, questions/answers) to guide them to physics concepts/principles, and then proceed to medical and biomedical applications, also emphasizing, when necessary, the importance of undertaking precautions and apply safety rules for staff and patients.
Bibliography	**(a) <u>Textbooks</u>** Davidovits, P. (2019). *Physics in Biology and Medicine* (5th ed.). London: Elsevier Academic Press. Davidovits, P. (2020). *Η Φυσική στη Βιολογία και την Ιατρική* (4η Έκδοση) Παρισιάνου Α. Ε. **(In Greek)** **(b) <u>References</u>** Adler, A., Carlton, R., & Kori, S. (2022). *Introduction to Radiologic & Imaging Sciences & Patient Care* (8th ed.). SAUNDERS. Baura, G. (2020). *Medical Device Technologies* (2nd ed.). Academic Press. Shanmugam, P., Chokkalingam, L., & Bakthavachalam, P. (2020). *Trends in development of medical devices*. Academic Press. Schreiner, S., Bronzino, J., & Peterson, D. (2017). *Medical instruments and devices - principles and practices*. CRC Press. Newman, J. (2013). *Φυσική για τις επιστήμες της ζωής*. Εκδόσεις Δίαυλος. **(In Greek)** *Through the services of the university library, access is provided to electronic repositories of scientific journals and articles, indicatively* ***ProQuest, Cambridge University Press*** and ***Science Direct*** *with thousands of scientific journals in the fields of health sciences.*
Assessment	• **Midterm written exam: 25%.** Includes multiple-choice questions, short and open-type questions. • **Case study & presentation: 15%.** Computer presentation or interview presentation of a medical device / equipment (physical principle of functioning, proper usage, precautions, references). • **Class participation: 10%.** Participate in class discussions and answer questions. • **Final written exam: 50%.** Includes multiple-choice questions, short and open-type questions.
Language	Greek / English