



Course Code BIOL-240	Course Title Elements of Biophysics	ECTS Credits 6
Prerequisites NURS-105, BIOL-110	Department Life and Health Sciences	Semester Spring
Type of Course Required	Field Science	Language of Instruction English
Level of Course 1 st Cycle	Lecturer(s) Dr Marios Nestoros	Year of Study 2 nd
Mode of Delivery Face-to-face	Work Placement N/A	Co-requisites None

Objectives of the Course:

The main objectives of the course are to:

- The purpose of this course is to give students an introduction to the principles of medical physics as well as to cultivate an appreciation for the importance of physics in medicine and health sciences

Learning Outcomes:

After completion of the course students are expected to be able to:

- Explain the basic ideas of geometrical optics and illustrate how images are formed through reflection and refraction and how image transmission and illumination is achieved in laparoscopic surgery.
- Recall the process of emission and absorption of electromagnetic radiation from biologic materials and describe how laser light is used in surgery and other types of medical treatment.
- Explain how ultrasound is generated and detected, how it propagates in tissue and describe qualitatively how it can be used to locate structures and form images in the human body.
- Describe qualitatively the interaction of ionizing radiation with tissue and explain how images of organs and body structures can be formed with a conventional radiograph, a CT scanner and a gamma camera.
- Explain ionizing radiation damage in the probabilistic and deterministic regime as well as the ways ionizing radiation can be used to treat cancer.
- Recognize the need for radiation protection and explain how this can be achieved in a clinic.
- Identify the basic mechanism of MRI imaging and some applications.
- Identify the physiological effects of electric current.

Course Contents:

1. Physical Optics and Vision: geometrical optics, refraction, reflection, mirrors and lenses, the human eye and mechanism of vision, anomalies of vision, total internal reflection, optical fibers and fiber optics in medicine, endoscopes.
2. Light as a wave, diffraction and interference, absorption emission spectra, lasers and applications in surgery, dermatology and photodynamic therapy. Advantages and drawbacks of laser in medicine.
3. Sound waves: ultrasound generation and detection, imaging with ultrasound. Doppler effect and its application in blood flow measurements. Safety in ultrasound imaging,
4. Diagnostic x-rays: atomic and nuclear structure, x-ray production, x-ray interaction with matter, image formation, x-ray detectors, quality of image, mammography, computed tomography.
5. Images from radioactivity: radioactivity fundamentals (types of radiation, radioactive decay, half life, (biological, physiological, effective), Gamma camera imaging, Emission Tomography (SPECT)
6. Radiotherapy: Ionization and absorbed dose in tissue, dose equivalent, biological effects of radiation, radiation damage: stochastic and deterministic regime, killing tumors with radiation, linear accelerators.
7. Radiation Protection and Safety: ALARA concept, ways to minimize radiation exposure for personnel and patients in clinics, radiation monitoring in clinics, dose limits.
8. Magnetic resonance imaging (MRI); basics of magnetism and nuclear magnetic moment, nuclear magnetic resonance, spin relaxation times, contrast in MRI, applications: sports medicine, functional MRI

Electric current, Ohm's Law, simple electric circuits, physiological effects of electric current, electrical safety.

Learning Activities and Teaching Methods:

Lectures (2 hours/week); Tutorials (1 hour/week).

Assessment Methods:

Laboratory Practical Sessions, Tests, Final Examination

Required Textbooks / Reading:

Title	Author(s)	Publisher	Year	ISBN
Introduction to Physics in Modern Medicine	Suzann Amador Kane	Taylor Francis and	2003 1 st Edition	0-415-30171-8

Recomended Textbooks / Reading:

Title	Author(s)	Publisher	Year	ISBN
Physics for the Health Sciences	Nave and Nave	Saunders	1985 3 ^d Edition	