COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10EK402**	**SEMESTER**	**8**
COURSE TITLE	**MEDICAL PHYSICS**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures (theory and exercises)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised Knowledge
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in the English language for Erasmus students
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS215/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Application of the basic principles of Physics and Technology and in particular of the Atomic & Nuclear Physics in Medical Imaging, Dosimetry and Radiotherapy. This course examines the basic application of ionizing radiation in medical diagnosis and treatment.

With the successful attendance and completion of the course, the student is in position to:

- Describe the basic characteristics of ionizing radiation.
- Understand the basic interactions of photons and charged particles with matter.
- Understand the basic principles underlying the imaging techniques of Nuclear Medicine.
- Identify the radiation risk and the protection procedures and methodology to be applied.
- Calculate all the physical quantities associated with the interaction of charged particles with matter (energy deposition, mean free path).
- Formulate the basic imaging principles governing projective and tomographic techniques for different types of radiation (X-rays, Single-Photon Emission Computed Tomography, Positron Emission and Magnetic Resonance Imaging).
- Calculate radiation dosimetry and explain the basic mechanisms for the application of ionizing beams to Radiotherapy.
- Design and analyze the operation of imaging devices in Nuclear Medicine.
- Compose and combine various tomographic techniques of medical physics.
- Critically evaluate radio-protection results and radio-therapy methods.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently /Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
Others…

The course aims at the following general competences

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Working independently
Team work
Working in an interdisciplinary environment
Project planning and management
Respect for the natural environment
Production of free, creative and inductive thinking
Analytical and synthetic thinking
Critical thinking
Planning
New Technology skills
Creativity
Determination
Flexibility / Adaptability
Problem solving

(3) SYLLABUS

- Radiation physics - Production of ionizing and non-ionizing radiation - Matter-radiation interaction. Charged-particle interaction with matter, Bragg Curve.
- Biological effects of radiation - Radiation protection - Dosimetry.
- Medical imaging - Diagnostic Radiology.
- Principles of computed tomography – Sinogram – The tomographic problem as an inverse transform - Radon transform.
- Computed Tomography (CT) – Single-Photon Emission Computed Tomography (SPECT) – Positron Emission Tomography (PET).
- Non-ionizing imaging techniques: Magnetic Resonance Imaging (MRI), Ultrasound imaging.
- Radiotherapy – Brachytherapy – Heavy-ion radiotherapy.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Yes Electronic communication with the students using ICT (Information and Communications Technology) Computer-aided lectures, use of video Projectors, eclass platform, instructors websites
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	

Activity	Semester workload
Lectures/ exercises)	52
Individual Study/ Study and Analysis of bibliography / Preparation	68
Writing reports/ essays	30
Course Total	**150**

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Final written exams in Greek. Oral examination. Written work (project).

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography

- Medical Physics (ΙΑΤΡΙΚΗ ΦΥΣΙΚΗ) (2nd Edition, in Greek) Collective work by the members of the Medical Physics Laboratory, Medical School, BROKEN HILL PUBLISHERS LTD (2013).
- K.Kappas and K. Theodorou: Radiation and Radiation Protection, (Ακτινοβολίες και Ακτινοπροστασία, in Greek) BROKEN HILL PUBLISHERS LTD (2017).

- Related academic journals:

- Annals of Nuclear Medicine
- Computers in Biology and Medicine
- IEEE Transactions on Image Processing
- IEEE Transactions on Nuclear Science
- IEEE Transactions on Radiation and Plasma Medical Sciences
- Journal of Instrumentation
- Medical Physics
- Nuclear Instruments and Methods in Physics Research (A & B)
- Physics in Medicine and Biology
- Radiation Physics
- The Journal of Nuclear Medicine