INTRODUCTION TO RADIATION PROTECTION	
GENERAL INFORMATIONS	
Course coordinator	Professor Dario Faj, PhD
Assistant/Associate	Asst. Prof. Mladen Kasabašić, PhD
Study Programe	Integrated undergraduate and graduate university study of Medicine in Croatian language
Status of the course	Elective
Year of study, semester	1st year, 2nd semester
ECTS	**2**
Workload (hours)	Lectures (9); Seminars (16)
Expected number of students	30

COURSE DESCRIPTION

Course objectives

Introducing basic concepts of radiological physics and the physical basics of using ionizing radiation in medical diagnostics and therapy. Understanding the dosimetry quantites and their measurements, and the biological effects of ionizing radiation exposure. Introducing models used to determine risk after exposure to ionizing radiation. International regulatory authorities and their recommendations for the safe use of sources of ionizing radiation. The use of the concept of radiation protection in developing procedures for safe work with sources of ionizing radiation, and understanding the importance of these procedures for the safety of employees and patients. Developing awareness of possible sources of irradiation of people, the consequences and ways in which irradiation can be avoided or reduced

Enrolment requirements and entry competencies

-

Learning outcomes at the program level

1.1, 2.1

Learning outcomes (5-10)

1. Interpret the interactions of tissues and different types of radiation as the basis of diagnostic and therapeutic methods in medicine
2. Interpret imaging parameters affecting the quality of diagnostic information (resolution, contrast, noise/signal relationship)
3. Measure the physical quantities used in radiation protection and interpret the results (dosimetry)
4. Evaluate the importance of procedures for safe work with sources of ionizing radiation for the safety of workers and patients
5. Evaluate the risk of exposure to ionising radiation according to the models accepted today for risk assessment
6. Apply the acquired knowledge in the interdisciplinary field in practice and independently continue to expand their knowledge in this field.

Course content

Lectures:

A historical review. The basics of radiation physics and interaction with matter. Radiation detection and detection devices. Physical quantities and units of measurement. Biological effects and models used to assess risks due to exposure to ionising radiation. Devices used in radiology, radiotherapy and nuclear medicine. Principles of protection against ionizing radiation. Dosimetric surveillance of employees. Health surveillance of employees. Specific aspects of protection in

radiology, radiotherapy and nuclear medicine. Quality control system in radiology, radiotherapy and nuclear medicine. Patient protection. Degree of exposure of employees in the Republic of Croatia. Degree of exposure to the patient. Possible hazards, accidents and accident resolution. Legal basis for protection against ionizing radiations of the Republic of Croatia.

Seminars:

1.Influence of international organizations on the design and implementation of radiation protection with particular reference to the use of radiation in medicine:

a)International Atomic Energy Agency (IAEA).

b)International Radiation Protection Commission (ICRP).

c)International Commission for Radiological Measures (ICRU).

d)World Health Organisation (WHO).

e)European Commission (EC).

2.National legislation and international standards in the field of radiation protection (in particular compliance with EU directives)

3.Exposure of the population from natural and artificial sources.

4.Factors on which the degree of damage depends.

5.Irradiation from external and internal sources, acute radiation syndrome. Risk of irradiation as a function of the age of the irradiated person

6.Restrictions on employees throughout history and reasons for changes in restrictions.

7.Typical doses of employees in different radiological tests, radiotherapy and nuclear medicine (comparison with natural irradiation in different geographical locations on Earth). Groups of employees working in radiation zones with extremely high doses.

8.Possible radiotherapy accidents. Quality control system as a tool for avoiding accidents.

9.Computational 3D planning of radiotherapy with a review of patient protection

10.Justification of medical irradiation (example and comparison of CT – traditional radiography for certain anatomical structures, possible use of non-ionizing radiation, MRI, ULTRASOUND). The responsibility of the doctor for the medical irradiation of the patient.

11.Recommendations regarding medical irradiation, pregnancy and breastfeeding. Ways to warn patients about the harmfulness of radiation and compare it with other risks.

12.Screening of patients (mammography, bone density,..) with a view to the justification of the

13.Parameters affecting dose reduction in patients for selected radiological examination. Typical doses of patients for various radiological tests.

14. Diagnostic reference levels (DRLs) and their importance in assessing the risk to patients.

15.Deterministic effects in interventional radiology with a view to the need to monitor patients undergoing the procedure

16.Monitoring of sources with reference to the need to introduce a quality control system for radiological procedures and image quality.

17.Image quality in traditional radiography and criteria for determining image quality. Examples of good and bad practice.

18.Mammographic devices (difference from classical radiographic devices).

19. Sources of radioactive waste in the hospital and ways to solve the problem.

20.Sources of ionizing radiation in fiction and influence on the perception of the danger of ionizing radiation in a wide population.

21.Biological effects of radiation: cellular and tissue response to radiation injury.

22.somatic and genetic, deterministic and stochastic effects. Acute and chronic radiation damage, lycalized and systemic injuries. Hormese

23.Acute radiation sickness, organic system syndromes. Biological dosimetry.

24.External and internal contamination and decontamination: basic rules.

25.Principles and methods of internal dosimetry. ICRP and MIRD concept. A full body counter.

Mode of teaching

Lectures; Seminars

Student obligations

Attendance of all forms of classes is mandatory, and the student must access all knowledge checks. The student can justifiably miss out on 30% of each of the forms of teaching. Undone exercise must be done subsequently.

Monitoring student work *(Connectivity of learning outcomes, teaching methods and grading)*

Teaching activity	ECTS	Learning outcome	Student activity	Assessement methods	Rating points	
					Min.	Max.
Attending course	0	1-6	Presence teaching	File	0	0
Seminars	1	1-6	Solve default problems on your own	Assay	0	5
Written exam	1	1-6	Learning for a written exam	Written exam	0	20
Ukupno	**2**				**0**	**25**

Format Rating
(1) written exam - 20 multiple-answer questions
(2) seminars
a) Problem - preparation of seminars on a given task - maximum 5 points. The seminar should have 4-6 pages of A4 format, font 12 without the front page. Each seminar is checked for plagiarism and the use of more than 30% of other people's text is evaluated with -3 points.

Criterion:
13-25 laid (P)

(3) oral exam (if the student wishes he can apply for an oral exam instead of a written exam).

Mandatory literature (available in the library and through other media)

Title	Number of copies in the library	Availability through other media
Jasminka Brnjas - Kraljević: Fizika za studente medicine, Medicinska naklada, Zagreb, 2001. ISBN: 9531761566.	20	
http://e-ucenje.civilna-zastita.hr/pluginfile.php/24240/mod_resource/content/2/Rendgenski%20ure%C4		Y

%91aj%20u%20medicini.pdf?forcedownload=1		

Supplementary literature
D.R.Dance, S.Cristofides; A.D.A.Maidment, I.D.McLean, K.H.Ng: Diagnostic Radiology Physics-A Handbook for Teachers and Students, http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1564webNew-74666420.pdf
Course evaluation procedures
Anonymous, quantitative, standardized student survey on the reception and work of teachers conducted by the Office for Quality of the Faculty of Medicine Osijek.
Note /Other
E-learning does not enter the norm of subject hours, but is used in teaching and contains links to different pages, video and audio materials available on websites.