COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCE		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	BIO_ΣΤΒ2	**SEMESTER**	6/8
COURSE TITLE	RADIOBIOLOGY		

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	2	3
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Field of Science (Radiobiology)
PREREQUISITE COURSES:	There are not prerequisite courses
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek. Teaching could be performed in English, in case foreign students attend the course.
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/BIO253/

(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*

By the end of this course the student should be able to:

- Recognize the types of ionizing radiations
- Know the most important sources of ionizing radiations
- Describe the modes of radiation interactions with matter
- Explain the difference in range of the different types of ionizing radiations
- Know the main interaction products between radiation and matter
- Have a concise knowledge of radiation quantities and their Units
- Describe the advantages and disadvantages of each detector and choose the most appropriate detector for a specific use

- Describe the advantages and disadvantages of the most widely used dosimeters
- Have a concise knowledge on the basic concepts of nuclear reactors operating, of nuclear weapons, accidents happened and their environmental consequences
- Know the effects of ionizing radiation on live organisms
- Manipulate safely radiotracers and know when and how can man use them

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

By the end of the course the student will have further developed the following skills/competences:

- Ability to demonstrate knowledge and understanding of essential facts, concepts and principles relating to Radiobiology
- Ability to apply such knowledge for solution of qualitative and quantitative problems of the familiar field
- Study skills needed for continuing professional development
- Ability to interactwith others on multidisciplinary problems

Generally, by the end of this course the student will, furthermore, have develop the following general abilities (from the list above):

- *Searching, analysis and synthesis of facts and information, as well as using the necessary technologies*
- *Adaptation to new situations*
- *Decision making*
- *Autonomous (Independent) work*
- *Exercise of criticism and self-criticism*
- *Promotion of free, creative and inductive thinking*
- *Respect to natural environment*

Work design and management

(3) SYLLABUS

- **Radioactivity – Ionizing Radiations:** Radioactivity. Sources of ionizing radiations. Modes of radioactive decay. Kinetic of radioactive decay. Radioactivity units.
- **Interactions of Radiation with Matter**: Charged particle interactions. Range of charged particles. Stopping power. Gamma ray interactions. Neutron interactions. Effects of radiation on matter. Chemical behaviour of ions, excited states and free radicals.
- **Dosimetry:** Radiation Quantities and Units. Measurement of exposure of Dose, Dose Equivalent and Exercises. Measurement of Dose by films, TLDs, pocket dosimeter, monthly inventory and recommended limits of Dose Equivalent
- **Types of radiation detectors**: ionization chamber, proportional counter, Geiger-Müller counter, scintillation detectors, semiconductor detector HPGe, liquid scintillation detector, methods correcting quenching
- **Nuclear Energy and Environment:** Principles of operation and types of nuclear reactors, accidents, nuclear weapons, environmental consequences
- **Effects of ionizing radiations on live organisms:** Sources of radiation exposure. Physics and Chemistry of Radiobiology. Radiolysis of water. Effects of radiation on biomolecules (proteins, carbohydrates, nucleic acids etc.) and chromosomes. Mutations-chromosomic defects. Target theory. Survival curves. Radiation protection
- **Biomedicinal applications of ionizing radiation:** Applications of X-rays and radionuclides in biomedical sciences. Tracers and radiotracers in Medicine and Biology. Manipulation and storage of radionuclides. Radionuclides in Radiodiagnostic and Radiotherapy (radiomedicals). Technetium in Radiodiagnostic. Radio-Immuno-Assays, (RIA) and Immuno-Radio-Metric Assays (IRMA)

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Use of Information and Communication Technologies (ICTs) (e.g. PowerPoint, video etc.) in teaching. The lectures content of the course for each chapter, all problems, in the form of a series of ppt files, and announces are uploaded on the internet, from where the students can freely download them.</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures (2 conduct hours per week × 13 weeks)</td><td>26</td></tr>
<tr><td>Hours for private study of the student and optional problems solving given in each lecture</td><td>46</td></tr>
<tr><td>Final written examination at the end of semester (3 conduct hours × 1 time)</td><td>3</td></tr>
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<tr><td>Course total</td><td>75</td></tr>
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<tr><td>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.</td><td>1. At the end of the semester there is a final written examination with multiple choice questions and short answer questions (open text books). Minimum passing grade: 5
Optional delivery of solved problems (at least 2) each week, given in each lecture. Addition of 1 grade to the final exam grade (if it’s higher than 5) of the students who have delivered all the solved problems and the percentage of the unit to the others, according to the number of solved problems each person has delivered.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- «BIOLOGICAL RESPONSES, MONITORING AND PROTECTION FROM RADIATION EXPOSURE», K.P. Mishra, Allahabad, India 2015
- «RADIOBIOLOGY FOR THE RADIOLOGISTS», Eric J. Hall, 5th Edition, LIPPINCOTT WILLIAMS & WILKINS, Philadelphia, 2000
- «ΚΛΙΝΙΚΗ ΡΑΔΙΟΒΙΟΛΟΓΙΑ», Γ. Α. Πλατανιώτης, Εκδ. UNIVERSITY STUDIO PRESS, Θεσσαλονίκη 2000
- «AN INTRODUCTION TO RADIOBIOLOGY», A. H. W. Nias, 2nd Edn, JOHN WILEY & SONS, Baffins Lane, 1998
- «RADIOISOTOPES IN BIOLOGY», R. J. Slater, Edition IRL PRESS AT OXFORD UNIVERSITY PRESS 1998
- «ΡΑΔΙΟΒΙΟΛΟΓΙΑ, Ακτινοβολίες και Ζωή», Λ. Χ. Μαργαρίτης, Εκδ. Θεμέλιο, Αθήνα 1996
- «INTRODUCTION TO RADIOBIOLOGY», M. Tubiana, J. Dutreix, A. Wambersie, D. K. Bewley, TAYLOR & FRANCIS 1990
- «ΔΟΣΙΜΕΤΡΙΑ ΚΑΙ ΒΙΟΛΟΓΙΚΕΣ ΕΠΙΠΤΩΣΕΙΣ ΤΩΝ ΑΚΤΙΝΟΒΟΛΙΩΝ», Σ. Χαραλάμπους, Εκδ. Π. ΖΗΤΗ & Σια Ο.Ε., Θεσσαλονίκη 1985
- «BIOLOGICAL RADIATION EFFECTS», Jürgen Kiefer, SPRINGER-VERLAG 1985

- Related academic journals:

1. International Journal of Radiation Biology
2. Radiation Biology
3. Molecular Radiobiology