

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
ABET COURSE SYLLABI

IEE2014 RADIATION AND SAFETY

Credits and contact hours:	5 UC credits / 5 hours (3 hours: Lecture and 2 hours: Independent Study)
Instructor's name:	Cristián Tejos
Course coordinator's name	To be defined
Textbook:	Ronald Kitchen RF and Microwave Radiation Safety, Newnes Second Edition, 2001
Course Catalog Description:	<p>Both, for the treatment of certain diseases and for doing biomedical imaging, human beings are exposed to several phenomena that could be potentially harmful for health.</p> <p>In radiotherapy, people are exposed to ionizing radiation (either particles or electromagnetic radiation), to destroy tumor cells. In Computer tomography (CT) Ionizing radiation (X rays) is used to form body images. In SPECT and PET imaging techniques, radioisotopes are given to the patient to assess functional aspects. In echography high energy ultrasound waves are used to form images of the interior of the body. In Magnetic Resonance, high frequency radio waves are used to excite protons so the image can be formed.</p> <p>Exposure to any of this phenomenon could potentially have harmful effects on health if they are not handled with extra care. Through this course, the students will understand the main physical phenomena used in therapy and imaging, being able to analyze main biological effects triggered by these phenomenon. Furthermore, they will measure and quantify exposure (dosimetry) and analyze different alternative to avoid or prevent unnecessary exposure or minimize exposure.</p>
Prerequisite Courses:	QIM100A General Chemistry II
Co-requisite Courses:	None
Status in the Curriculum:	Requerid
Course Learning Outcomes:	<ol style="list-style-type: none">1. To understand and to analyze the fundamental physics associated to the generation of ionizing radiation, radio waves and ultrasound waves.2. To understand and to analyze the biological effect associated to the exposure of the mentioned physical phenomenon.3. To understand and analyze how exposure can be measured and the underlying concepts behind dosimetry.

4. Manage and design strategies to avoid or reduce exposure.

**Relation of Course to ABET
Criteria:**

- a. Knowledge of mathematics, science and engineering
- b. Design and conduct experiments: analyze and interpret data
- d. Multidisciplinary teams
- e. Identify, formulate, and solve engineering problems
- f. Professional and ethical responsibility
- k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

- 1. Ionizing Radiation
 - a. X-Ray, Gamma Ray, Alpha, Beta and Positron generation.
 - b. Attenuation and dispersion Phenomena: Photoelectric effect, Compton Dispersion, Rayleigh effect, Coupling
 - c. Ionizing Radiation Measurement
 - d. Dosimetry
 - e. Biological Effects
- 2. Ultrasound
 - a. Ultrasound wave generation
 - b. Heat, standing waves and cavitation generation
 - c. Biological Effects
- 3. Radio Frequency Waves
 - a. Radio Frequency propagation
 - b. Dosimetry: Specific Absorption Rate (SAR)