10708-718 (8) Interaction of Radiation (1½ ℓ, 1½ p)

2014

Course summary:

Radiation sources, the process of radioactive decay as source of radiation, interaction of photons and neutrons with matter, isotope production with reactors and accelerators, nuclear fission as a source of radiation, lasers and microwaves as sources of radiation.

Outcomes of course:

The aim of the course is to indicate useful, purposeful, safe and innovative application of radiation. It is a core module for advanced courses in medical physics and radiation applications in industry.

Lecturer:

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Course content:

Formal lectures
The contents of the course is structured, if possible, to accommodate the background and/or special needs of the students.

1. **Radiation sources.**
   Units and definitions, Fast electron sources, Heavy charged particle sources, Sources of electromagnetic radiation, Neutron sources.

2. **The process of radioactive decay as source of radiation.**
   Radioactive decay series; Differential equations; "Bateman-equations"; Biological losses and radioactive decay; Effective half-life, Production of radioactive isotopes.

3. **Interaction of photons and neutrons with matter.**
   Emphasis is placed on energy transfer to the matter through which the radiation passes. Gamma-rays, neutrons.

4. **Isotope production with reactors and accelerators.**
   General equation for production / decay of radioactive isotopes.

5. **Nuclear fission as a source of radiation.**
   Process applications: Reactors; Criticality accidents

6. **Lasers and microwaves as sources of radiation.**

Practical (Tutorials):

Study material:

There is no prescribed handbook; reference is often made to:

1. FH Attix, ***Introduction to Radiological Physics and Radiation Dosimetry***.
2. GF Knoll, ***Radiation Detection and Measurements*.**

Other sources also used are

1. H Cember, ***Introduction to Health Physics***
2. Evans, ***The Atomic Nucleus***
3. CM Lederer et al. ***Table of Isotopes***
4. E Segré, ***Nuclei and Particles***
5. HE John, ***The Physics of Radiology***
6. EB Paul, ***Nuclear and Particle Physics***
7. Translation: RF Peierls, ***Kinematics of Nuclear Reactions***
8. G Hertz, ***Lehrbuch der Kernphysik***

Learning opportunities:

Assessment:

Methods of Assessments
The students are evaluated continuously by means a number of written, open book tests at regular intervals during the semester.
[Note: In order to obtain entry into the training internship to become a qualified Health Physicist, an examination that contributes at least 80% of the final performance mark in the module is required.]

Venue and time of assessment opportunities
See ***timetable*** on Physics home page

Availability of marks:
Within one week after the assessment opportunity

Calculation of final mark for the module:
See the requirements in **Methods of Assessment** above.