10706-753 (8) Radiation Protection (1½ ℓ, 1½ p)

2018

Course summary:

Radiological protection, the shielding of neutrons and gamma rays.

Module relevance in programme:

This is a compulsory module for Physics students enrolled in the Honours programme in Radiation and Health Physics. On successful completion of this programme students are eligible for entry into a two-year internship in Medical Physics at an academic hospital in South Africa. Successful completion of the internship students is a prerequisite to becoming registered Medical Physicist with the Health Professions Council of South Africa (HPCSA).

The topics covered in this module re
late to how mainly gamma-rays and neutrons interact with human tissue resulting in the deposition of energy (dose). Dose limits and ways to minimize unwanted dose are also discussed.

The knowledge gained by students in this module will be directly applicable to much of their future day-to-day activities as a Medical Physicist working in a hospital or specialist consulting rooms where ionizing radiation is used.

Outcomes of course:

To present a sound conceptual foundation in the theory and practice of:

- RADIOLOGICAL PROTECTION
- THE SHIELDING OF IONISING RADIATION

Lecturers:

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Mentor:

The Department of Physics has appointed a staff member as mentor for each year of its physics programme to be available to students for consultation. Students should feel free to discuss general issues related to the physics programme or specific modules in the programme with the relevant mentor, in addition to usual consultations with their individual lecturers of modules.

The mentor for the Honours programme and its modules is Prof KK Müller-Nedebock kkmn@physics.sun.ac.za.

Course content:

The contents of the course may, if possible, partially be adapted to the background and/or particular needs of the students. This course is presented by persons actively working in the field of radiological protection.

RADIOLOGICAL PROTECTION
The following subjects are treated, using the 2005 recommendations of the ICRP as basis:

- Physical quantities used in radiological protection: The absorbed dose, equivalent dose, effective dose, and the committed effective dose.
- Radiation and tissue weighting factors.
- Biological aspects of radiological protection.
- Deterministic and stochastic effects of ionising radiation.
- Additive and multiplicative risk projection models.
- Aggregated detriment.
- The conceptual framework of radiological protection.
- Practices and intervention.
- The system of protection in practices.
- Generic scientific principles of radiological protection.
- The control of occupational exposure.
- The control of public exposure.
- Biological dosimetry
- Radiotherapy

THE SHIELDING OF NEUTRONS AND GAMMA-RAYS

1. Fundamental principles of neutron and gamma-ray shielding: The shielding of neutrons: neutron moderation, neutron reaction dynamics, neutron scattering kinematics, angular distribution of scattered neutrons, average energies and emission angles of scattered neutrons.
2. The shielding of photons: Bremsstrahlung, photo-electric absorption, Compton scattering and pair production.
3. Complementary shielding materials.
4. Fundamental principles of shield optimisation.

Practical (Tutorials):

Radio Biology Practical: Cytogenetic assessment of damage induced by high and low LET radiations

Study material:

There is no single prescribed handbook.

Learning opportunities:

Radiation instrumentation and applications: iThemba LABS site tour

Assessment:

Methods of Assessments
The students are evaluated continuously by means a number of written tests and assignments at regular intervals during the semester. An examination paper completes the evaluation.

Venue and time of assessment opportunities
Set in consultation with the students.

Availability of marks:
Within a reasonable time

Calculation of class mark:
As determined by the HPCSA.

Calculation of final mark for the module:
As determined by the HPCSA.

Admission to examination:
As determined by the HPCSA.

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