10467-750 (8) Physics of Radiation Dosimetry / Radiology (1½ ℓ, 1½ p)

2016

Course summary:

Radiation Dosimetry:
Measurement of radiation, definitions of physical quantities, energy transfer, electronic equilibrium, Bragg-Gray cavity, interaction of charged particles with matter, radiation quality and range, proton dosimetry, interaction with human tissue.

Physics of Radiology:
The X-ray machine, conventional radiography, computer tomography, ultrasound, magnetic resonance imaging.

Outcomes of course:

Radiation Dosimetry
After completion the module, the student is expected to be:

- familiar with the basic principles, quantities, and units used in dosimetry of ionizing radiation.
- understanding the deposition of energy in matter through interactions between electron- and photon beams with matter.

Physics of Radiology
The objective of the course is to introduce the student to the basic principles of imaging in Diagnostic Radiology. The student will be acquainted with imaging modalities such as Computed tomography, Ultrasound and Magnetic resonance imaging.

Lecturers:

Radiation Dosimetry
Mr Mohlapoli Mohlapholi
Medical Physics Division, Gene Louw Building, Tygerberg Hospital, Tel: +27 21 9386039,
Fax: +27 21 9310804, E-mail: hlaps@sun.ac.za

Physics of Radiology
Lecturer to be confirmed:

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 HC Eggers eggers@physics.sun.ac.za

Course content:

Radiation Dosimetry

1. **Dosimetry Principles, Quantities and Units**
   Photon fluence and energy fluence, KERMA, CEMA, absorbed dose, stopping power, relationships between dosimetric quantities, cavity theory

2. **Radiation Dosimeters**
   Properties of dosimeters, ionization chamber dosimetry systems, film dosimetry, luminescence dosimetry, semiconductor dosimetry, other dosimetry systems.

3. **Proton Theraphy**
   Physical properties of protons, sources of protons, proton accelerators suitable for radiotherapy, general and clinical requirements of a dedicated medical proton accelerator, beam transport system, shielding of the beam transport system, beam penetration and precision, radiation dose and dose rate, shape of the Bragg distribution.

Physics of Radiology

1. **The X-ray Unit.**
   Production of X-rays: X-ray tubes; X-ray generator; Factors influencing x-ray emission.
2. **Conventional Radiography.**
   Differential absorption; Filters; Radiographic film; Intensifying screens; Image intensifiers; Grids; Mammography; Fluoroscopy; Image quality; Quality assurance.
3. **Digital Radiography.**
   Computed Radiography; Digital Radiography; Flat Panel Detectors; PACS.
4. **Computed Tomography (CT).**
   Basic principles; Historical development - Generations; Acquisition and reconstruction of images; CT-numbers; Image Quality; Artifacts.
5. **Ultrasound.**
   Physical principles; Production of ultrasound - transducers; Beam Characteristics; Resolution; Echo Display modes; Image Quality; Artifacts; Doppler Ultrasound; biological effects.
6. **Magnetic Resonance Imaging (MRI).**
   Physical principles; Generation and detection of the MR signal; Pulse sequences; Localization of the MR signal; Image characteristics; Artifacts; Instrumentation; Safety and Bio-effects.

Study material:

<u>Radiation Dosimetry</u>

1. ***Radiation Oncology Physics: A Handbook for Teachers and Students***, E.B. Podgorsak, IAEA 2005.

<u>Physics of Radiology</u>

Study notes. The following text books are not prescribed, but will be used complementary to the study notes:

1. JT Bushberg, JA Seibert, EM Leidholdt, JM Boone, ***The Essential Physics of Medical Imaging***, Second Edition, Lippincott Williams and Wilkens 2002.
2. SC Bushhong, ***Radiologic Science for Technologists: Physics, Biology and Protection***, 6th Edition, Mosby, 1997.

Learning opportunities:

Assessment:

Methods of Assessments

The students will write a test during the course. At the end of the module an oral exam will be taken on the full contents of the specific module.

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 HPCSA requirement

Calculation of final mark for the module:

As determined by HPCSA requirement

Admission to examination:

As determined by HPCSA requirement