10465-751 (8) Physics of Nuclear Medicine (1½ ℓ, 1½ p)

2016

Course summary:

Radiation detectors, the gamma camera, quality control of the gamma camera, computers in nuclear medicine, principles of SPECT, principles of PET, statistics of counting, basic principles of tracer studies, whole body counters.

Outcomes of course:

The purpose of the module is to familiarize the student with:

- The theory and principle of operation of all nuclear instrumentation.
- The quality control measures of nuclear instrumentation.
- The practical uses of radioactive sources.
- The theoretical principles of common tracer techniques.
- Computer processing techniques of nuclear medicine images.
  The student will receive an introduction into the role of the medical physicist in a Nuclear Medicine Department.

Lecturer:

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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 HC Eggers eggers@physics.sun.ac.za

Course content:

1. **Radiation Physics**
   Radioactive decay, interaction of radiation with matter, attenuation and decay calculations.
2. **Radiation Detectors**
   Types of radiation detectors, ionization chambers, Geiger counters, scintillation counters, principles of operation, concept of dead time.
3. **The Gamma Camera**
   Principle of operation, Collimators, NaI(Tl) Crystal, Performance Parameters.
4. **Quality Control of the Gamma Camera**
   All quality control procedures as per NEMA.
5. **Computers in Nuclear Medicine**
   Organisation of Gamma Camera Computer, Programming Principles, Applications in Nuclear Medicine, Gated Cardiac Studies, Functional Images.
6. **Principles of SPECT**
   Acquisition, Filtered Back projection, Iterative Reconstruction, Attenuation Correction, Quality Control.

7. **Principles of PET**
   Principles of PET, Acquisition, Reconstruction, Attenuation Correction, Quality Control.
8. **Statistics of Counting**
   Poisson Distribution, Chi-squared test, Combination of Errors.
9. **Basic Principles of Tracer Studies**
   Terminology, Blood Volume, Fick's Principle,
10. **MIRD**
    Principles of medical internal radiation dosimetry, Effective dose calculations
11. **Radiation protection in Nuclear Medicine**
    Design of Hot lab, spillage handling, License requirements for radionuclides, waste disposal,

Practical (Tutorials):

Study material:

1. ***Physics in Nuclear Medicine***, Second Edition, J.A. Sorenson, M.E. Phelps. Grune & Stratton 1987.
2. ***Performance Measurements of Scintillation Cameras.*** NEMA Standards Publication NU1-2001

Learning opportunities:

Assessment:

Methods of Assessments
The students are evaluated continuously by means of a number of written tests at regular intervals and a final assessment (3 hours written paper) at the end of the semester.

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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 a