ST MARY’S UNIVERSITY

TWICKENHAM, LONDON

BSc Degree Examination students registered for

Level **SIX**

Title: **Medical Physics**

Code: **APH6004**

Semester: **TWO**

Date: **May 22nd 2019**

Time: **09.30-11.30 AM**

TIME ALLOWED: **2** HOURS

Answer **SECTION A** and **ONE of the other two sections** (B or C)

**STUDENTS CAN USE A NON PROGRAMMABLE CALCULATOR**

**Section A:**

**[60 marks]**

1. Explain the difference between emission and transmission tomography **[2 Marks]**
2. Is it better to use long-lived radionuclides or short-lived radionuclides for nuclear medicine applications? Explain your answer **[2 Marks]**
3. What is a radionuclide and what are its main properties? **[2 Marks]**
4. What is a radiopharmaceutical and what is used for? **[2 Marks]**
5. Describe in your own words what Acute Radiation Sickness is and what its effects on living organisms are. **[5 Marks]**
6. Describe in your own words the principle of operation of a scintillation detector.

**[3 Marks]**

1. List the three main gaseous detectors? Briefly describe the use of each of them.**[9 Marks]**
2. List the three general categories of effects resulting from exposure to low doses of radiation. **[3 Marks]**
3. Some radiation risks are related to radiation dose by a linear, no-threshold model. What does “linear” and “no-threshold” mean? **[2 Marks]**
4. Write a 1 page essay on “Inertial measurement units and their clinical use to gather quantitative data from patients affects by Parkinson Disease in order to obtain an accurate diagnosis” **[15 Marks]**
5. Write a 1 page essay on “Radioluminescence and its applications in biomedicine” **[15 Marks]**

**Section B:**

**[40 marks]**

1. What is the aim of Reflection Tomography? What are the pros and cons of this imaging technique. **[3 Marks]**
2. Describe the four main limits of Reflection Tomography **[4 Marks]**
3. What anatomical regions can be imaged by CT-scan? **[1 Mark]**
4. What is Cone Beam Computed Tomography. **[1 Mark]**
5. Where does the biomagnetism of the human body originate from? **[1 Mark]**
6. Write an essay (1 to 2 pages) on “The principles of production of radionuclides for nuclear medicine applications”

In particular discuss the following points:

* Nuclear structure and binding energies of radionuclides
* Nuclear reactions and their main properties
* Operational principles of a cyclotron

**[30 Marks]**

**Section C:**

 **[40 marks]**

1. What are the three most important performance parameters for non-imaging radiation detectors and counters? **[3 Marks]**
2. What are the two properties the sensitivity of a non-imaging detector depends on?

 **[2 Marks]**

1. What is a dose calibrator and what is used for? **[2 Marks]**
2. What are the two main applications of a well counter? **[2 Marks]**
3. When does Acute Radiation Syndromes occur? **[1 Mark]**
4. Write an essay (1 to 2 pages) on “The effects of radiation of human cells”

In particular discuss the following points:

* Natural and human-made sources of radiations
* Methods for measuring levels of radiation
* Impact of radiations on human health

**[30 Marks]**

**END OF EXAMINATION**