UNIVERSITY OF JAFFNA, SRI LANKA

BACHELOR OF SCIENCE IN MEDICAL LABORATORY SCIENCES

SECOND YEAR FIRST SEMESTER EXAMINATION-AUGUST 2017

MLSMT 2144 MEDICAL LABORATORY TECHNOLOGY I

Date: 30.08.2017   **Time: 3 Hours**

<u>ANSWER ALL EIGHT QUESTIONS.</u>

<u>ANSWER PARTS A AND B IN SEPERATE ANSWER BOOKS</u>

<u>PART A</u>

1.

1.1 Describe the construction and working principle of a modern rotating

    X-ray Tube.   (30 Marks)

1.2 Give the advantage of rotating anode x-ray tube.   (15 Marks)

1.3 What is meant by attenuation of X-rays?   (10 Marks)

1.4 Distinguish between quality and quantity of an X-ray beam.   (25 Marks)

1.5 Briefly describe the "heel effect" in X-ray tube.   (20 Marks)

2.

2.1 Give the principle of luminescence.   (15 Marks)

2.2 Define "thermo luminescence dosimeter (TLD)" in dosimetry.   (15 Marks)

2.3 What is meant by "glow curve" in TLD?   (20 Marks)

2.4 Describe how TLD reader measures the amount of radiation.   (20 Marks)

2.5 Briefly explain the working principle of a free air ionization chamber.   (30 Marks)

3.

3.1 Define "linear energy transfer (LET)" in ionizing radiation.   (10 Marks)

3.2 Briefly describe how LET related with radiation action type.   (20 Marks)

3.3 Write short note on

       3.3.1 Ionizing radiation induced chromosomal aberration   (35 Marks)

       3.3.2 Role of oxygen in ionizing radiation damage   (35 Marks)

4.

4.1 Define the following terms that are used in radiation treatment planning.

      4.1.1 Clinical target volume (CTV)   (10 Marks)

      4.1.2 Planning target volume (PTV)   (10 Marks)

4.2 Define "bolus" in radiotherapy and give the uses.   (30 Marks)

4.3 Discuss the importance of simulation in radiotherapy.   (25 Marks)

4.4 Give the importance of multiple radiation treatment beams that are

    used in external beam radiotherapy.   (15 Marks)

4.5 Give two names of immobilization devices used in radiotherapy.   (10 Marks)

5.

5.1 Distinguish between nuclear fission and fusion with suitable example.   (20 Marks)

5.2 Briefly describe long and short term effects of radiation.   (25 Marks)

5.3 List the advantages and disadvantages of "radioimmunoassay (RIA)".   (20 Marks)

5.4 Briefly explain the difference between the valid event and detector

    scatter event in gamma camera imaging.   (20 Marks)

5.5 Briefly describe the importance of effective radiation dose in radiation

   protection.   (15 Marks)

PART B

6.

6.1 Draw the circuit diagram of a bridge rectifier circuit with a smoothing capacitor C

    and a load resistance R.   (20 Marks)

6.2 Sketch the variation of the output voltage with time across the load

    resistance R.   (20 Marks)

6.3 State any four properties of an ideal operational amplifier.   (20 Marks)

6.4 For each of the following two circuits, drive an expression for the output signal

    in terms of resistances and input signals.   (40 Marks)

(a)
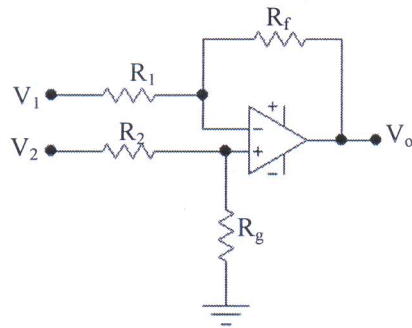
(b)
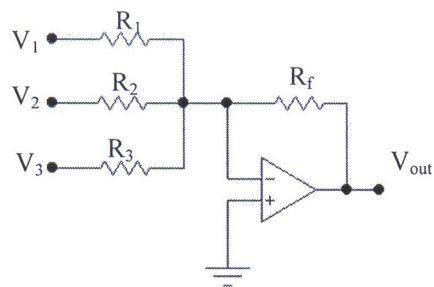
7.

7.1 List four unique characteristics that differentiate laser beam from ordinary light? (10 Marks)

7.2 Briefly explain how a light beam interacts with an active medium when

it transverses through it? (10 Marks)

7.3 What is meant by population inversion? (20 Marks)

7.4 How population inversion is achieved within an active medium? (10 Marks)

7.5 Briefly explain the photodynamic therapy (PDT) used for treating tumour? (20 Marks)

7.6 Explain the application of different amount of heat energy of a laser used

in medical applications? (30 Marks)

8.

8.1 What are the main types of imaging modalities? (25 Marks)

8.2 Describe the main functions of the cathode, anode and housing of an X-ray tube. (15 Marks)

8.3 What makes tungsten a good choice for both the filament and the target material? (20 Marks)

8.4 What is the difference between the actual focal spot size and the effective focal

spot size? (10 Marks)

8.5 How intensity of the X-ray output produced within a X-ray tube can be adjusted? (10 Marks)

8.6 What does the kV setting on a console control? (10 Marks)

8.7 How are Characteristic and Bremsstrahlung X-rays produced? (10 Marks)