UNIVERSITY OF JAFFNA, SRI LANKA

BACHELOR OF SCIENCE IN MEDICAL LABORATORY SCIENCES

SECOND YEAR FIRST SEMESTER EXAMINATION- NOVEMBER 2014

MLSMT 2104 MEDICAL LABORATORY TECHNOLOGY- I

Date: 01.12.2014 **Time: 3 Hours**

ANSWER ALL EIGHT QUESTIONS

ANSWER EACH PART IN SEPARATE ANSWER BOOK

PART A

1.

1.1. Define the following.

1.1.1. Radioactivity. (10 Marks)

1.1.2. Half life of a radioisotope. (10 Marks)

1.1.3. Linear energy transfer (LET). (10 Marks)

1.2. Calculate the activity of 4000Bq of Co-60 source after 5 years (half-life of a Co-60 is 5.26 years). (30 Marks)

1.3. Explain "Photo electric effect" and the factors influence on their strength. (40 Marks)

2.

2.1. Explain the steps for interaction ofgamma radiation with tissue. (20 Marks)

2.2. Discuss the ionizing radiation induced lesions in DNA? (40 Marks)

2.3. Describe the factors that influence on the biological effects of ionizing radiation. (40 Marks)

3. Write short notes on

3.1. Basic principle and medical applications of "Radioimmunoassay (RIA)". (30 Marks)

3.2. Vacuum Concentration. (30 Marks)

3.3. Scintillation detector. (40 Marks)

4.

4.1. Explain the principle of"gamma camera" used in diagnosis of cancers. (40 Marks)

4.2. Briefly describe the features of radionuclides used in Nuclear Medicine Imaging. (30 Marks)

4.3. List the safety precautions handledby technicians in Nuclear Medicine laboratory. (30 Marks)

PART B

5. Radiotherapy is widely used in the treatment of cancer. With the advancement of radiation technology and incorporation of computer based planning, many cancers are cured when detected in early stages.

5.1. Describe the use of radiation in detecting cancers in early stages. (15 Marks)

5.2. Describe cell cycle and mention phases that are radio sensitive and radio resistant. (15 Marks)

5.3. Describe the mechanism of cell kill by radiation. (20 Marks)

5.4. List types of fractionations used in radiotherapy. (15 Marks)

5.5. Describe the principles used in radiation protection. (20 Marks)

5.6. List the short term and long term side effects of ionizing radiation. (15 Marks)

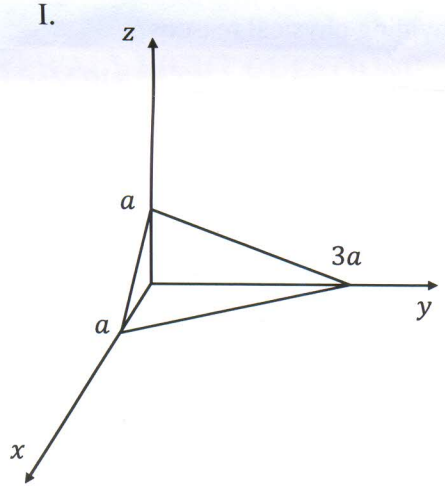
PART C

6.

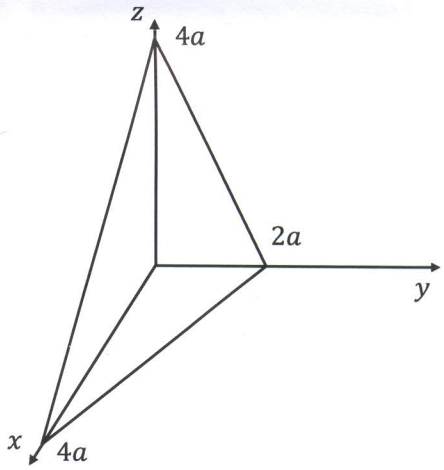
6.1. What is meant by Miller indices? (16Marks)

6.2. Determine the Miller indices for the planes shown in the following figures.

I.



II.



(24 Marks)

6.3. Briefly describe an experimental method to find out the crystal structure of a finely powdered sample. (20 Marks)

6.4. Write down the assumptions made in X-ray diffraction while studying crystal structures. (20 Marks)

6.5. Find the Bragg angles corresponding to reflections from the planes (111) and (210) of a cubic crystal with lattice constant 2.62 Å. Assume that the wavelength of the monochromatic X-ray beam used in this study is 1.54 Å. (20 Marks)

7.

7.1. Briefly describe the nature of optical fibers? (20 Marks)

7.2. Draw the cross-section of an endoscope tip and indicate its important parts. (25 Marks)

7.3. List down the advantages and disadvantages of optical fibers. (20 Marks)

7.4. Compute the power densities for the medically realistic situations described below.

7.4.1. Photocoagulation of the retina using 500 μm diameter spots and a laser power of 200 mW. (10 Marks)

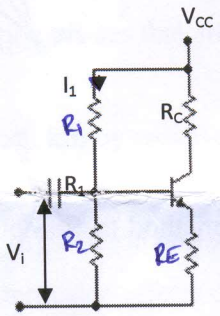
7.4.2. Photo-vaporization of opacities within the eye using 50 μm diameter spots and a laser power setting of 2 W. (10 Marks)

7.5. Compute the ratio of these two power densities. (05 Marks)

7.6. Hence, justify the values found in part (7.5) by providing physical reasons? (10 Marks)

8.

8.1. Following is a potential divider biased common emitter amplifier with a transistor made up of Germanium. Estimate the values of R_1, R_2 and R_E, if $R_C = 2.2\ k\Omega$, $V_{CC} = 9\ V$, $V_{BE} = 0.3\ V$, $I_1 = 10\ I_B$, $\beta = 50$ and the operating point of the amplifier is $(2\ mA, 3\ V)$.



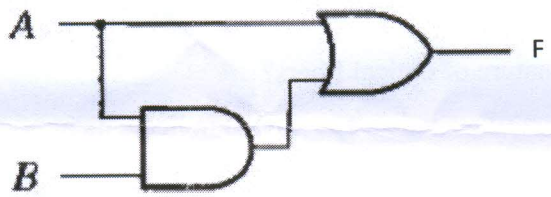
(40 Marks)

8.2. Simplify the following Boolean equations.

8.2.1. $A\bar{B} + A(\overline{B + C}) + B(\overline{B + C})$. (10 Marks)

8.2.2. $[A\bar{B}(C + BD) + \bar{A}\bar{B}]C$. (10 Marks)

8.3. Answer the questions (8.3.1) and (8.3.2) based on the following figure.



8.3.1. Write down the output F in terms of A and B. (10 Marks)

8.3.2. Write down the complete truth table to illustrate output 'F'. (30 Marks)