

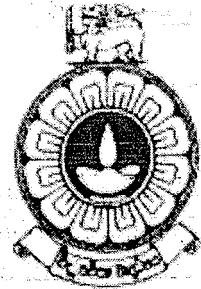
The Open University of Sri Lanka

Diploma In Science In Laboratory Technology (DSLTL)- 2023/2024

Laboratory Techniques in Physics - PHD3603

Final Examination

Duration: Two (02) hours



07th January 2024

Time: 9.30 am - 11.30 am

- Answer four questions only

Question 01

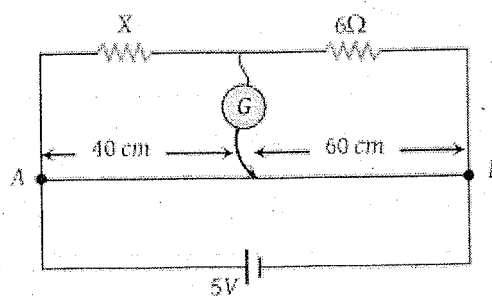
A. (i) State the Ohm's law with the relevant graph

(04 Marks)

(ii) A 100 W headlamp bulb lights up using a 12 V car battery. Determine the current flowing and the resistance of the bulb (assume the resistance of the connecting wires of the circuit is negligible)

(08 Marks)

B. In the circuit shown below, a meter bridge is in its balanced state. The meter bridge wire has a resistance of $1 \Omega/\text{cm}$.



(i). Calculate the value of the resistance X

(05 Marks)

(ii). Calculate the current drawn from the battery (internal resistance of the battery can be negligible).

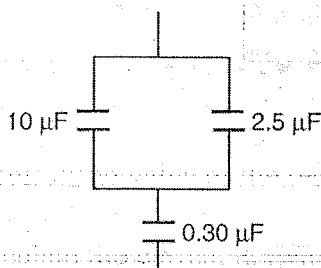
(08 Marks)

Question 02

- A. (i) What are the properties of “ α ” and “ β ” radiations **(06 Marks)**
- (ii) Write down **four** precautions you should bear in mind for personal protection against radiation hazards when handling radioactive sources **(04 Marks)**
- B. Cobalt-60 (Co-60) is a radioactive isotope used in cancer treatment. Co-60 has a half-life of 5 years. If a hospital starts with 1000 mg sample of Co-60 for cancer treatments.
- (i) What will be the final mass of the Cobalt-60 after 10 years? **(05 Marks)**
- (ii) What will be the decayed mass of the Cobalt-60 after 10 years? **(05 Marks)**
- (iii). How many milligrams of Cobalt-60 will be needed to be purchased to replenish the original supply of 1000 mg? **(05 Marks)**

Question 03

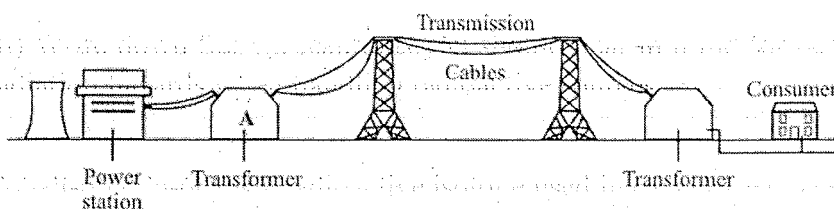
- A. (i). What are the factors depending on a capacitance of a capacitor **(05 Marks)**
- (ii) In a parallel-plate capacitor, the distance between the plates is 3 cm, the area of each plate is 15 cm^2 , and the voltage across them is 5 V. Calculate the capacitance of the capacitor. ($\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$) **(05 Marks)**
- (iii) Find the total capacitance of the combination of capacitors in the following circuit. **(05 Marks)**



- B. (i) Define the capacitive reactance of a capacitor **(05 Marks)**
- (ii). Determine the capacitive reactance when a 4.7 F capacitor is connected to a 1 kHz AC voltage source? **(05 Marks)**

Question 04

Electrical energy of the power station is distributed around the country by a network of high voltage cables as shown in the following figure.



- A. (i) Why is alternating current (AC) used for power generation and distribution instead of direct current (DC)? **(05 Marks)**
- (ii) Transformers are an essential part of the distribution system. Explain why? **(05 Marks)**
- B. The power station generates 100 MW of power at a voltage of 25 kV. Transformer A, which links the power station to the transmission cables, has 44 000 turns in its 275 kV secondary coil.
- (a) Write down the equation which links the number of turns in each transformer coil to the voltage across each transformer coil **(05 Marks)**
- (b) Calculate the number of turns in the primary coil of transformer A **(10 Marks)**

Question 05

- A. (i) What are the initial steps to be taken in order to ensure the accuracy in measuring the mass of an object using a top pan balance? **(05 Marks)**
- (ii) The mercury in glass thermometers are not used to measure temperatures below $-35\text{ }^{\circ}\text{C}$. Explain the reason. **(05 Marks)**
- (iii) Describe how you would check the accuracy of calibration on a 50 cm^3 burette and a 100 cm^3 volumetric flask. **(05 Marks)**
- B. Write short notes about **two** topics of followings **(10 Marks)**
- Ionization Gauge
 - Primary and secondary cells
 - Tare facility
 - Pirani gauge

Question 06

A. (i) State Boyle's law **(05 Marks)**

(ii) Two bulbs of different volumes are separated by a valve. The valve between the 2.00 L (Liter) bulb, in which the gas pressure is 1.00 atm, and the 3.00 L (Liter) bulb, in which the gas pressure is 1.50 atm, is opened. What is the final pressure in the two bulbs when the temperature remains constant and the same in both bulbs?

(05 Marks)

B. (i) What are the advantages of using oil rather than mercury in a vapor diffusion pump? **(05 Marks)**

(ii) What decides the pumping speed for a given vapor diffusion pump?

(05 Marks)

C. Briefly write down one factor that adversely affects the efficiency of a rotary oil pump, and a method for overcoming it. **(05 Marks)**