**THE OPEN UNIVERSITY OF SRI LANKA**
**ADVANCED CERTIFICATE PROGRAMME IN LABORATORY TECHNOLOGY**
**FINAL EXAMINATION-2010/2011**
**PSC2324 - LABORATORY TECHNIQUES IN PHYSICS**

**Time Duration: Two (02) hours**

**Date: 30th January 2012** **Time: 10.30 a.m. – 12.30 p.m.**

Answer **four (4)** questions only

## PART B

1. (a) What is meant by SI units? Write down the seven primary standards and the physical quantities relate to them.

   (b) Derive the following units with the primary standards

   (i) Newton (ii) Coulomb (iii) Volts (iv) Watt (v) Hertz

   (c) Describe briefly how you make a vernier scale for measuring length. Calculate the minimum reading of the vernier scale, if 19 mm in a meter scale is divided into 20 parts in the vernier scale.

   (d) Write down five measuring instruments that you find in the laboratory with vernier scales.

2. (a) What do you understand by suck-back in the experiments conduct in general labs? Write down the gas law in physics that governs the suck-back.

   (b) Explain one experiment briefly where suck-back has a potential danger and write two methods to prevent suck-back in such experiments.

(c) Write down the Boyle's law for real gasses.

(b) A student has a defective barometer which read as 700 mm at the atmospheric pressure (760 mm of mercury) because some air is trapped inside. At this situation the height of the glass tube was 1 m above the mercury level of the bath. Then he pressed the tube into the mercury bath until the mercury column decreased further to 660 mm in the tube. Calculate the length which he pressed the glass tube into mercury.

3. (a) What is the main difference between the *AC* and *DC* current? Briefly explain how you produce *AC* and *DC* current for demonstration in the lab.

(b) A student report that electrical equipment in the lab does not work. Write down the steps you take to locate the fault in the electrical equipment and mention the action you take at each step as the person in charge of the instrument.

(c) Write down the Ohm's Law. Hence show that the power, $P$ consumes by electrical equipment is given by, $P = V^2/R$, where $V$ is the voltage and $R$ is the resistance.

(d) 1500 W hotplate is connected to 230 V *AC* plug point in the lab. If a cartridge fuse is fitted with the plug, calculate the resistance of the wire in the fuse just enough to tolerate the current drawn by the hotplate. Then suggest a suitable value for the fuse (in amperes) for this plug. Do you recommend the hotplate to be connected to 5 A or 13 A plug point? Justify your answers.

4. (a) Write down three uses and the respective applications of transformers.

(b) Briefly explain the principle of operation of a transformer and point out three factors that reduce its efficiency.

(c) A transformer steps down the 230 V mains to 12 V. The secondary winding is found to be 60 turns. How many turns more do you need to add to the secondary to make the output 15 V?

(d) How do you construct a power supply to convert *AC* mains to get *DC* low voltage? Explain your answer with the help of a labeled diagram

5. (a) What is the purpose of capacitors in electrical circuits? Discuss two factors that have to be considered when selecting a capacitor for a circuit.

(b) Why it is unsafe to touch a circuit with capacitors that have been connected to high voltages even after they are unplugged from the mains. What are the safety measures you have to follow when opening an instrument with such circuits for service?

(c) Write down expression for capacitance of a capacitor with

(i) Area ($A$) and separation ($d$) of the plates and permittivity ($\varepsilon$)

(ii) Charge ($Q$) and voltage ($V$).

(d) Parallel plate capacitor is made by two aluminium plates of 10 $cm^2$ separated by 1 mm layer of aluminium oxide. If it is connected to 220 V, calculate the charge accumulate on a plate. If the aluminium oxide layer is grown to a thickness of 2 mm after disconnecting the capacitor from the voltage source, calculate the voltage between the two plates. The permittivity of aluminium oxide is $11\varepsilon_0$ where $\varepsilon_0 = 8.85 \times 10^{-12}\ Fm^{-1}$.

6. (a) Name the radiations emitted by radioactive element in radioactive disintegration process and describe their characteristics such as mass, charge, depth of penetration comparably.

(b) Write down the safety precautions that you follow for your personal protection when handling radioactive sources.

(c) How do you define the half-life of a radioactive element? Hence show that

$$log\left[\frac{Activity\ remaining}{Initial\ activity}\right] = \log\left(\frac{1}{2}\right) \times \frac{Time\ elpsed}{half\ life}$$

(d) Calculate the time taken for 10 g of radium source to reduce to 1 g, when the half life of radium is 5.8 years. (log ½ = - 0.301)

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