

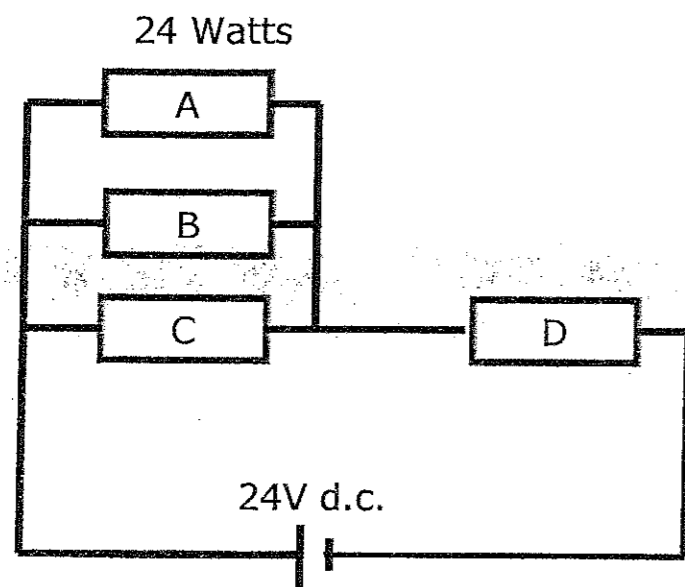
WRITE ALL YOUR WORK IN THE ANSWER BOOK PROVIDED.
 EVERY ANSWER SHOULD INCLUDE ALL WORKINGS, NECESSARY
 DIAGRAMS AND FORMULAE.

START EACH ANSWER ON A FRESH PAGE.

Choose any FIVE questions.

1(a) Define Ohm's Law (3 marks)

(b) A direct current circuit is made up of three Resistors in parallel A,B & C and connected in series with Resistor D (refer to diagram). The known values of the resistors are Resistor B = 3Ω , Resistor C = 2Ω and Resistor D = 1Ω . Current flowing in Resistor B is 4 Amps.



Calculate:-

- What is the value of Resistor A if the resistor dissipates 24Watts? (5 marks)
- What is the current flowing in Resistor C? (2 marks)
- What is the voltage across Resistor D? (2 marks)
- What is the heat dissipated in Resistor B? (2 marks)
- What is the current value flowing in the whole D.C. circuit? (3 marks)
- If the parallel group of resistors A,B&C are replaced by one resistor, what is its value in Ohms? (3 marks)

2(a) Explain what is meant by the terms "Utilization Factor" and "Maintenance Factor" as applied to an illumination scheme? (4 marks)

2(b) Complete the following table:

Quantity	Quantity Symbol	Unit
Luminous Flux	F	
	I	cd (Candela)
illuminance		lx (Lux)
Luminance	L	
Luminous Efficiency		lm/W

(5 marks)

2(c) An examination hall of 10m x 30m is to be illuminated to a level of 250 lux. PL fittings are to replace the old incandescent fitting. The space-height ratio is 1.2 and the luminous efficacy is 82 lm/W are given by the manufacturer of the PL fitting. The height of the fittings is suspended 2m above the working level.

- Estimate the number of fittings required. (5 marks)
- The power of each fitting. (3 marks)
- Draw a plan of the room and show the position of the PL fitting. (3 marks)

Assume Utilization factor 0.5 and Maintenance factor 0.8.

3(a) Draw a basic charging circuit for a battery and describe how a battery is charged using the constant current charging method. (6 marks)

(b) A battery has 56 cells in series and is charged using the constant current charging method. During charging the constant current is 8A with the e.m.f. rising from 1.8V to 2.4V per cell. Each cell has an internal resistance of 0.008 ohm.

- Calculate the battery terminal voltage at the beginning and at the end of the charge. (6 marks)
- If the battery is completely discharged in 40 hours at 4A at an average voltage of 1.96V per cell after being charged for 24 hours at 8A with an average voltage of 2.2V per cell, calculate the ampere hour and the watt hour efficiencies of the battery. (8 marks)

4 A balanced Wheatstone Bridge circuit is used to measure the resistance of a coil. R1 and R2 are fixed resistances of value 80 ohm and 20 ohm respectively. R4 is a variable resistance while R3 is the coil under test. Balance of galvanometer is obtained when R4 is set to 21.5 ohms. The bridge circuit is supplied by five (5) cells in series of 2 volts each with internal resistance of 0.2 ohm per cell.

a) Draw the Wheatstone Bridge circuit. (5 marks)

b) Calculate:

- The coil resistance. (3 marks)
- The current in R1. (3 marks)
- The voltage across R1. (3 marks)
- The current in the coil. (3 marks)
- The voltage across the coil. (3 marks)

- 5(a) A special purpose heater having a resistance of 3 ohms is supplied from a battery of emf 6V and internal resistance of 0.48 ohms. Calculate:
- The power dissipated in the heater. (3 marks)
 - The percentage (%) of the total power wasted in the internal resistance. (3 marks)
- (b) A 3 kW immersion heater rated at 240 Volts is in use in a certain installation but due to voltage drop, the voltage at its terminals is only 228 volts. Calculate:
- Percentage voltage drop. (3 marks)
 - The actual power consumed by the heater. (4 marks)
 - The percentage (%) reduction in the power of the heater caused by the volts drop. (4 marks)
- (c) Calculate the current taken by a motor whose output power is 2.5 kW and efficiency is 72% when it is working from a 230 Volts supply. (3 marks)
- 6 A circuit consists of a resistance of 12 ohms, a capacitance of 320 microfarad and an inductance of 0.08 H, all in series.. A supply of 240 Volts, 50 Hertz is applied to the ends of the circuit.
- Draw the circuit diagram. (2 marks)
 - Draw the phasor diagram (not to scale). (4 marks)
 - Calculate the current in the coil. (4 marks)
 - Calculate the p.d. across each element of the circuit. (6 marks)
 - The frequency of supply at which the current would be at unity p.f (4 marks)

END OF PAPER

**EXAMINATION FOR THE ISSUE OF A LICENCE TO
ACT AS WIREMAN - LIC 'A'**

Paper I (Theory)

Time Allowed - 3Hrs

July 2013