29.11 ELECTRICITY (448)

29.11.1 Electricity Paper 1 (448/1)

SECTION A (52 marks)

Answer **all** the questions in this section.

1 (a) State **three** conditions required for **combustion** to take place.

(b) Name **three** types of fire extinguishers. (3 marks)

2 (a) List **four** types of institutions which **offer craft certificate** courses in electrical engineering. (2 marks)

(b) Explain the cause of a dry joint on a printed circuit board. (2 marks)

3 (a) Name **four** types of capacitors. (2 marks)

(b) Two capacitors **having capacitance of 6 μ F and 4 μ F** are connected in series across a 200V dc supply.
Calculate the:

(i) voltage across each capacitor;
(ii) charge on each capacitor. (4 marks)

4 (a) Name **two** types of secondary cells. (1 mark)

(b) Six cells each of emf 1.5V and internal resistance of 1.2Ω are connected in parallel to supply a load of 10Ω. Calculate the current through the load. (3 marks)

5 (a) Determine the resistance of carbon **resistor** whose colour codes are:

(i) green, yellow, brown, gold;
(ii) blue, orange, red. (4 marks)

(b) The current through a 0.5H coil of **inductance** changes 6A to 3A in 0.04 seconds. Calculate the value of **e.m.f induced** in the coil. (2 marks)

6 (a) State **three** characteristics of lines of **magnetic** flux. (3 marks)

(b) State the function of each of the following features of analogue instruments:

(i) deflecting;
(ii) controlling;
(iii) damping. (3 marks)

7 (a) Give **three** reasons why copper is commonly used as a conductor material in electrical installations. (3 marks)

(b) State **two** advantages of light gauge pvc conduits over the heavy gauge pvc conduits. (2 marks)

8 (a) Compare **two** operational characteristics of silicon diode and Germanium diodes. (2 marks)

(b) Sketch a half wave rectifier and its output waveform. (3 marks)

9 (a) Sketch a diagram of four pole dc machine and label five main parts. (5 marks)

(b) State **one** possible cause of each of the following symptoms:

(i) motor will not reach full speed;

(ii) iron box overheats;

(iii) fluorescent lamp flickers continuously. (3 marks)

10 Figure 1 shows an oblique view of a stepped block.

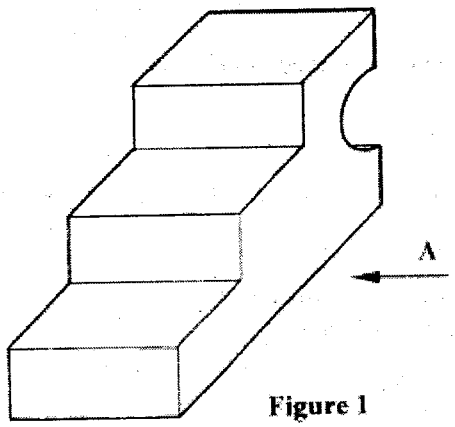


Figure 1

Sketch in first angle projection the three orthographic views taking the front elevation in the direction of arrow **A**. (5 marks)

SECTION B (48 marks)

Answer any **four** questions from this section.

11 (a) With the aid of a labelled diagram, explain the operation of a single phase transformer. (8 marks)

(b) A 200 KVA, 11000v/240v 5Hz single phase transformer has 600 turns on the primary side. Calculate:

(i) the primary and secondary currents;

(ii) the number of secondary turns. (4 marks)

12 (a) Show that the total resistance of two resistors connected in parallel is equal to the product of their resistance divided by the sum of their resistance. (2 marks)

(b) State the meaning of the following terms as applied to alternating current:
(i) frequency;
(ii) amplitude;
(iii) periodic time. (3 marks)

(c) A coil of inductance 30mH and 5Ω resistance is connected across a 240 volt 50 Hz supply. Calculate the:
(i) circuit current;
(ii) phase angle;
(iii) power factor;
(iv) apparent power;
(v) active power. (7 marks)

13 (a) List **three** metal parts that are exempted from earthing in a domestic installation. (3 marks)

(b) Give **three** reasons why a verification of polarity test is carried out in a completed domestic installation. (3 marks)

(c) Draw a line diagram of a national grid system showing typical voltages at each stage. (6 marks)

14 With the aid of a diagram, describe the construction and operation of a moving coil instrument. (12 marks)

15 (a) Draw a labelled circuit diagram of a PNP transistor amplifier in common base configurations. (3 marks)

(b) Table 1 below shows a bill of materials used to construct a stabilized dc supply.

No	Description of material	Quantity
1	Double pole switch	1
2	Double wound transformer	1
3	Rectifier diodes	4
4	Electrolytic capacitor	1
5	Carbon resistors	1
6	Zener diode	1
7	Connecting wires	Several

Draw a circuit diagram of the power supply. (9 marks)

EXERCISE 1

Using the components, materials and equipment provided, connect the circuit as shown in figure 1. (4 marks)

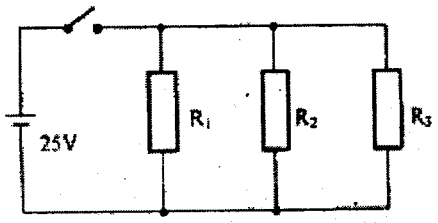


Figure 1

(a) Measure and record the total circuit current I_T (1 ½ marks)

I_T .....

(b) Measure and record the current through each of the following resistors.

R_1(mA) .....

R_2(mA) .....

R_3(mA) ..... (4 ½ marks)

(c) In the circuit:

(i) replace R_3 with R_4 (2 marks)

(ii) repeat step (a) above (1 ½ marks)

I_T .....

(iii) repeat step (b) above and record the following:

R_1(mA) .....

R_2(mA) .....

R_3(mA) ..... (4 ½ marks)

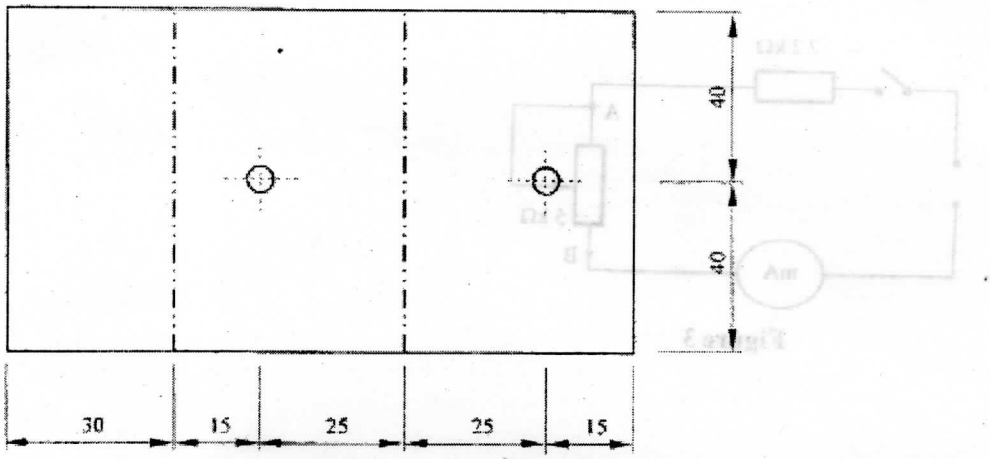
(d) (i) State the effect on the current when R_3 is replaced with R_4. (1 mark)

(ii) State the relationship between total circuit current (I_T) and the branch current. (1 mark)

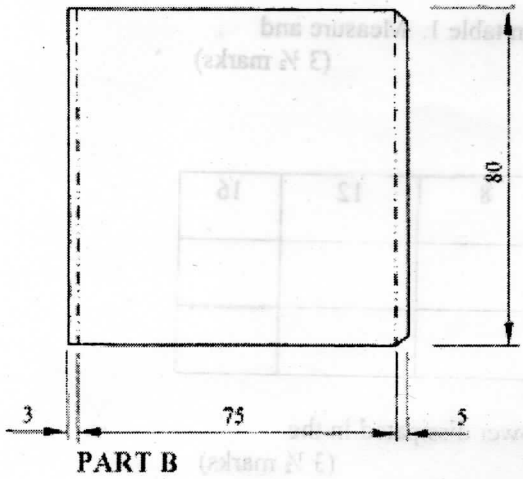
EXERCISE 2

Use the tools, equipment and materials provided to make the object shown in figure 2.

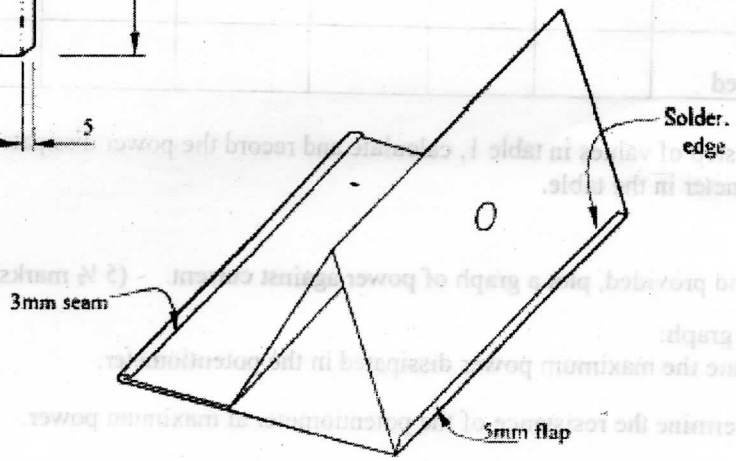
(20 marks)



PART A



PART B



EXERCISE 3

Using the components, materials and equipment provided, connect the circuit as shown in figure 3. (5 ½ marks)

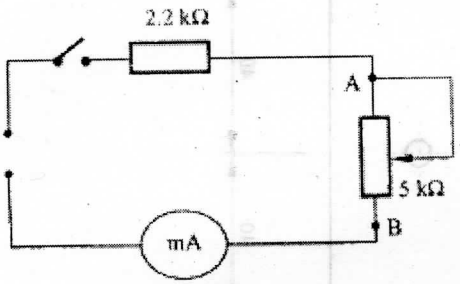


Figure 3

Perform the following tasks:

(a) Vary the potentiometer to obtain each of the voltages shown in table 1. Measure and record corresponding currents. (3 ½ marks)

Table 1

Voltage (v) across AB	0	2	4	6	8	12	16
Current (mA)							
Power Dissipated							

(b) For each step of values in table 1, calculate and record the power dissipated in the potentiometer in the table. (3 ½ marks)

(c) On the grid provided, plot a graph of power against current. (5 ½ marks)

(d) From the graph:
(i) state the maximum power dissipated in the potentiometer.

(ii) determine the resistance of the potentiometer at maximum power. (2 marks)

EXERCISE 4

Figure 4 shows a block diagram of the prefabricated transistor amplifier circuit provided.

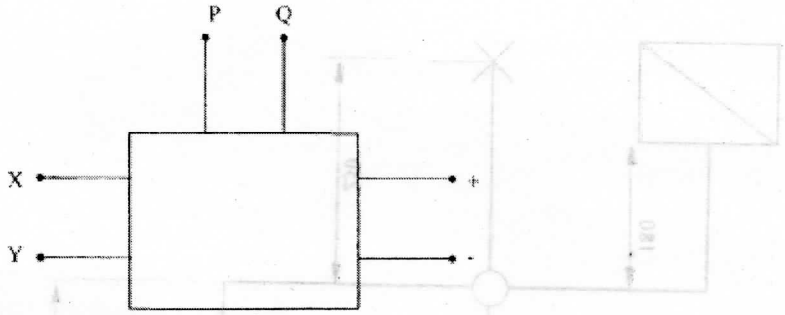


Figure 4

Perform the following tasks:

(a) Connect:

(i) the microammeter to points PQ to measure base current.
base current:.....

(ii) the milliammeter to points XY to measure collector current.
collector current: ..... (2 marks)

(b) Turn the switch to the ON position.

(c) Adjust R_1 to obtain each of the base current values in table 2. Measure and record the corresponding collector current.

Table 2

BASE CURRENT (μA)	COLLECTOCR CURRENT (μA)
10	
20	
30	
40	
50	

(5 marks)

(d) Using the values in table 2, plot the graph of I_C against I_B. (4½ marks)

(e) From the graph, determine the Beta (β) of the transistor. (2 marks)

(f) Draw a schematic diagram of the circuit. (6½ marks)

EXERCISE 5

Figure 5 shows a layout of a lighting circuit. Using PVC sheathed wiring system, install the circuit such that the lamp is controlled independently by S_1 and S_2. (20 marks)

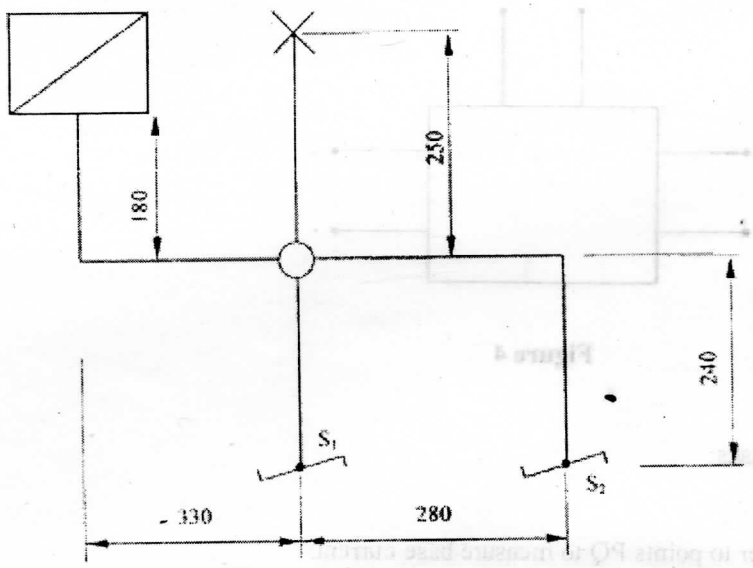


Figure 5