

29.20 ELECTRICITY (448)

29.20.1 Electricity Paper 1 (448/1)



MANYAM FRANCHISE
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SECTION A (52 marks)

Answer all the questions in this section.

- 1 (a) Outline the procedure of rescuing a person in contact with a live conductor in a workshop. (3 marks)
- (b) State **four** duties of an electrical technician in a large company. (2 marks)
- 2 (a) Outline the procedure of drilling a hole in a metal work piece. (2 marks)
- (b) Describe the construction of each of the following parts of a lead acid battery:
 - (i) positive plate;
 - (ii) separator;
 - (iii) casing. (3 marks)
- 3 (a) List **four** methods of generating electricity for the national grid. (2 marks)
- (b) Distinguish between self induction and mutual induction. (3 marks)
- (c) Calculate the total charge in the capacitors shown in figure 1. (3 marks)

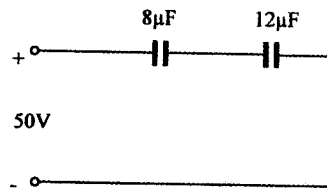


Figure 1

- 4 (a) Define R_c time constant. (1 mark)
- (b) Four resistors are connected as shown in figure 2.

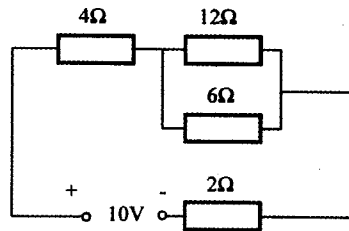


Figure 2

- Calculate:
- (i) the total circuit resistance
 - (ii) power dissipated in the 2 Ω resistor (4 marks)

- 5 (a) Name the **two** types of ac machines. (1 mark)
- (b) List **four** parts of a three-phase induction motor. (2 marks)
- (c) An alternator is operated at a speed of 1500 rpm to generate a voltage of 50 Hz. Calculate the number of pair poles. (2 marks)
- 6 (a) A meter movement system is designed to have a full scale deflection of $50 \mu\text{A}$. If it is used as an ohmmeter using 1.5v battery, calculate the value of resistance to give full scale deflection. (1½ marks)
- (b) State **three** advantages of digital measuring instruments over analogue measuring instruments. (1½ marks)
- (c) Describe the **two** methods of identifying faults in electrical equipment. (4 marks)
- 7 Draw a sketch of the magnetic flux around two parallel conductor carrying current in the same direction. Indicate the direction of force between the conductors. (3 marks)
- 8 (a) State the meaning of the term “final circuit”. (1 mark)
- (b) Outline **four** regulations regarding ring final circuits that supply 13A socket outlets. (4 marks)
- 9 (a) Explain the term “Zener voltage”. (2 marks)
- (b) Sketch a schematic circuit diagram of a biased PNP transistor connected in the common-emitter mode. (3 marks)
- 10 Figure 3 shows two orthographic views of a component.

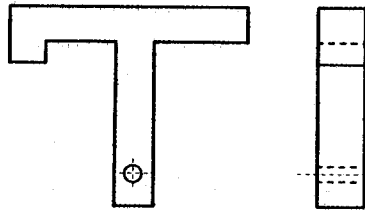


Figure 3

Sketch in good proportion the oblique view of the component. (4 marks)

- 12 (a) State two differences in construction between power transistor and general purpose transistor. (2 marks)
- (b) Explain the meaning of each of the following transistor ratios;
- (i) dc alpha;
- (ii) ac beta. (4 marks)
- (c) Figure 5 shows an amplifier circuit whose current gain is 100.

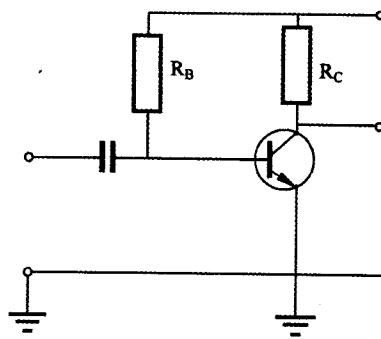


Figure 5

If VCE is 10v, VBE is 0.7v and IC is 10mA, calculate the value of:

- (i) R_B ;
- (ii) R_C . (6 marks)
- 13 (a) (i) Differentiate between fusing current and current rating of a fuse.
- (ii) State two disadvantages of rewirable fuses. (4 marks)
- (b) Draw a labelled diagram of a single-stroke electric bell and explain how it operates. (8 marks)

14 (a) A sine wave has a period of 100ms. Calculate its frequency. (1½ marks)

(b) Figure 6 shows a parallel RL circuit.

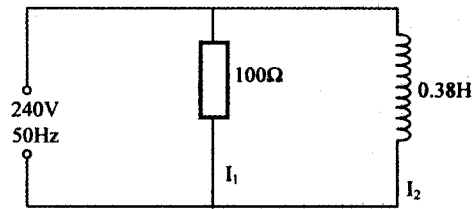


Figure 6

(i) Calculate:

- current I_1 and I_2 ;
- total current;
- power factor;
- phase angle.

(ii) Draw the phaser diagram. (10½ marks)

15 (a) Use labelled diagrams to show the construction of each of the following types of transformer:

- core;
- shell. (6 marks)

(b) A transformer rated 240/12v and 96% efficiency supplies a 10-watt load.

Calculate:

- primary current;
- power loss in the transformer. (6 marks)

EXERCISE 1

Using the materials, equipment and measuring instruments provided, perform the following tasks:

- (a) Connect the circuit as shown in figure 1.

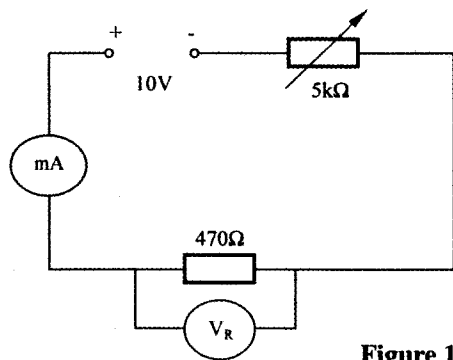


Figure 1

- Let the examiner check your work. (1½ marks)
- (b) Connect the circuit to the power supply. (½ marks)
- (c) Turn the power on and adjust the potentiometer to obtain each of the voltages (V_R) shown in table 1. In each case read and record the corresponding current I .

V_R (volts)	I (mA)	POWER (mW)
3		
4		
5		
6		
8		

Table 1 (7½ marks)

- (d) For each value of V_R , calculate the power dissipated in the 470 Ω resistor and complete the table. (5 marks)
- (e) Using the values in table 1 draw the graph of power against voltage V_R . (5½ marks)

EXERCISE 3

- (a) Using the given equipment and components, connect the circuit shown in figure 3.

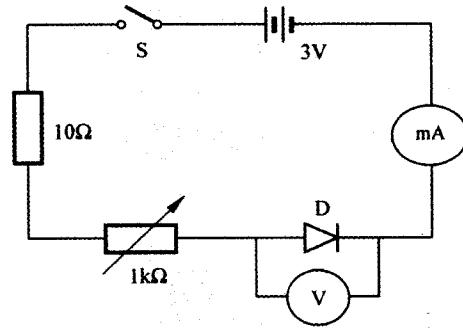


Figure 3

Let the examiner check your work.

(3½ marks)

- (b) Close switch S.
- (d) Adjust the potentiometer to obtain the values given in table 2. In each case, measure and record the corresponding currents.

VOLTAGE (V)	CURRENT (mA)
0.2	
0.5	
0.6	
0.7	
0.8	

Table 2

(10 marks)

- (e) Using the values in table 2, plot a graph of current against voltage.
- (d) From the given circuit:

(6½ marks)

- (i) Identify the devices labelled:

F _____

G _____

H _____

- (ii) Determine the values of the resistors labelled:

R1 _____

R2 _____

R3 _____

(6 marks)

EXERCISE 4

Figure 4 shows a block diagram of the electronic circuit provided.

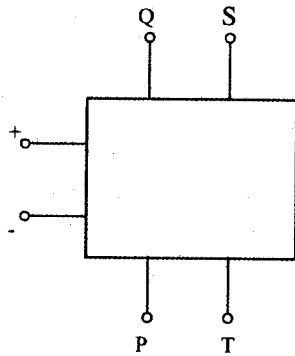


Figure 4

Carry out the following tasks:

(a) With the power supply off:

- (i) Connect the milliammeter between Q and S.
- (ii) Connect the circuit to the power supply.
Let the examiner check your work.

(2 marks)

(b) Turn on the power supply and adjust it to obtain the given voltages, E_s in table 3. For each value of E_s , measure and record the corresponding values of:

- (i) voltage across P and T
- (ii) current through QS.

(10 marks)

E_s	E_{P-T}	I_{Q-S}
2		
5		
6		
8		
10		

Table 3

(c) From the results obtained, state **one** practical application of the circuit.

(2 marks)

EXERCISE 5

Figure 5 shows the layout of a power final circuit. Using PVC sheathed wiring system, install the circuit such that the sockets are connected in radial. (20 marks)

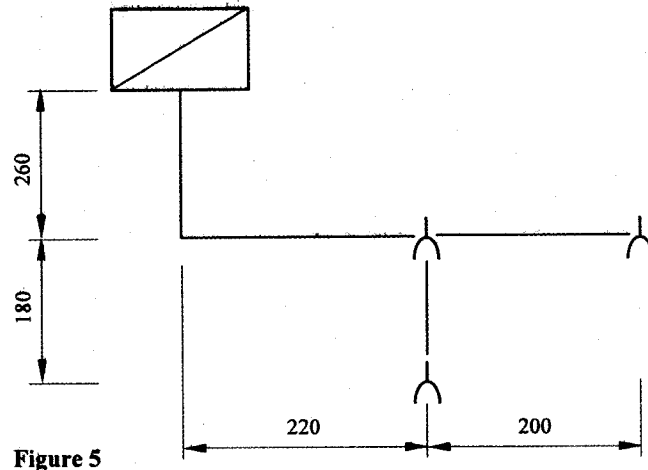


Figure 5