BASIC ELECTRICAL CIRCUITS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

The question paper consists of two parts : PART-A and PART-B. Both are compulsory.

PART – A

Marks – 25

All questions are compulsory.

1. Answer the following questions :   5

    (i) A 10 watt resistor has a value of 120Ω. What is the rated current through the resistor ?

    (ii) Three 2 ohm resistors are connected to form a triangle. What will be the resistance between any two corners of the triangle ?

[Turn over

(iii) Should the resistance of a voltmeter be low or high ?

(iv) A uniform wire of resistance R is divided into 10 equal parts and all of them are connected in parallel. What will be the equivalent resistance ?

(v) An electric fan and a heater are marked 100W, 220V and 1000W, 220V respectively. What are the resistances of the heater and the fan ?

2. Choose the correct answer : 10

(i) The current provided by an AC generator is alternating current that has

(a) Square waveform

(b) Triangular waveform

(c) Sine or cosine waveform

(d) None of the above.

(ii) The capacity of a charged body to do work is called its

(a) Electric resistance

(b) Electric capacitance

(c) Electric potential

(d) None of the above.

(iii) The opposition offered by a substance to the flow of electric current is called its

(a) Resistance

(b) Capacitance

(c) Power

(d) None of the above.

(iv) The resistance R of a conductor depends on

(a) Its length

(b) Its area of X-section

(c) Temperature

(d) All of the above.

(v) The reciprocal of resistance of a conductor is called its

(a) Conductivity

(b) Conductance

(c) Resistivity

(d) None of the above.

(vi) The rate at which work is done in an electric circuit is called its

(a) Electric power

(b) Electric resistance

(c) Electric capacitance

(d) Electric potential

(vii) The unit of electrical energy will be

(a) Watt-sec

(b) Watt-hour

(c) Kilowatt-hour

(d) All of the above.

(viii) In case of liquids, Ohm's law is

    (a) Fully obeyed

    (b) Partially obeyed

    (c) There is no relation between current and p.d.

    (d) None of the above.

(ix) The characteristics of a parallel circuit

    (a) Voltage across each resistor is the same

    (b) Current through any resistor is inversely proportional to its resistance

    (c) Total current in the circuit is equal to the sum of currents in its parallel branches

    (d) All of the above.

(x) When there is a break in any part of a circuit, that part is said to be

    (a) Open circuited

    (b) Short circuited

    (c) All of the above.

    (d) None of the above.

3. Match the following statements in column A with the correct answer from column B. 5

Column A	Column B
Unilateral circuit	Parallel sources
Superposition theorem	± 20%
Tolerance for blank stripe	Junctions of network
Millman's theorem	Multiple sources
Kirchhoff's current law	Diode rectifier

4. Read the following statements. Write true or false against each : 5

   (i) Charge of an electron is 1.987×10^{-19} coulomb.

   (ii) When the number of valence electrons of an atom is less than 4, the material is usually a metal and a conductor.

   (iii) A substance which has very few free electrons is called an insulator of electricity.

   (iv) One ampere of current is said to flow through a wire if at any cross-section one coulomb of charge flows in one second.

   (v) When the magnitude of current does not change with time, it is called a steady current.

PART–B

Marks – 45

Answer any *five* questions.

5. (a) Find the equivalent resistance between terminal A and B as shown in Fig.1.   3

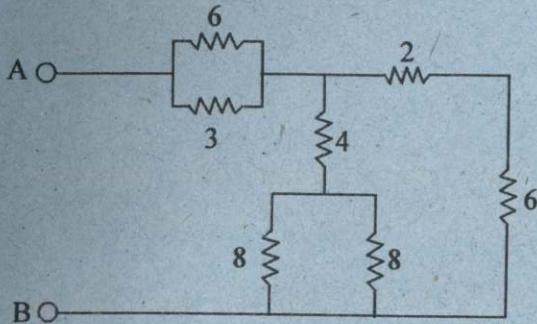Fig. 1

(b) Using Star to Delta conversion, find the resistance between the terminals B and C of circuit shown in Fig. 2.   6
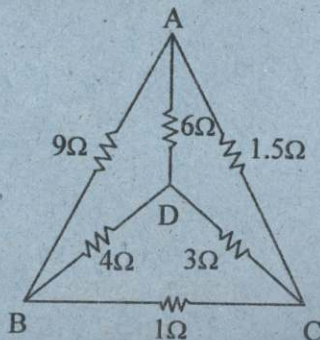

Fig. 2

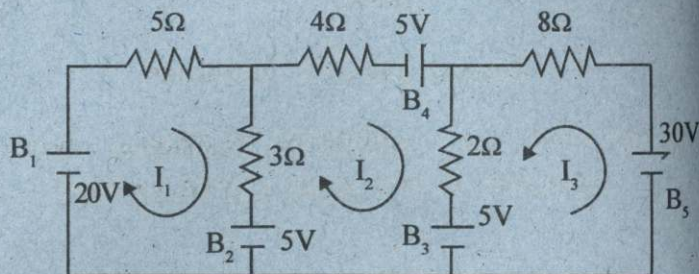6. (a) Find the value of I_1, I_2 and I_3 in Fig. 3.

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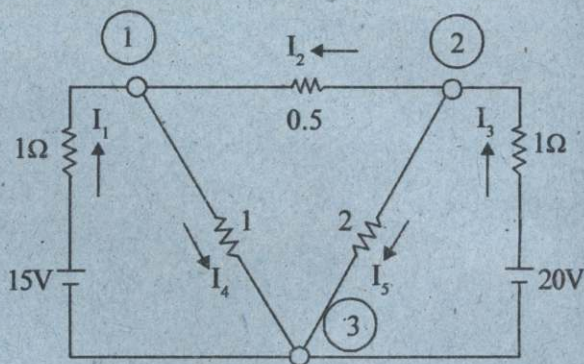Fig. 3

(b) State and explain the Kirchhoff's laws applied to electric circuits.

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7. (a) Using Nodal Analysis find out the current flowing through the 0.5Ω resistance (I_2) in Fig. 4.
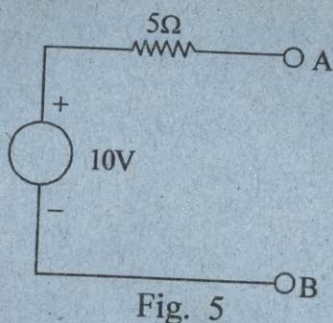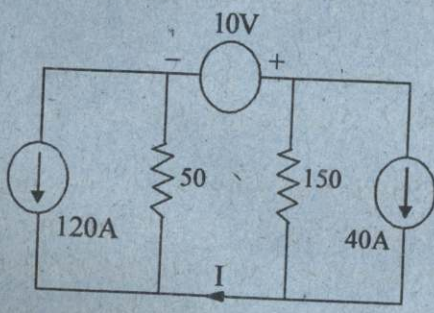
6

Datum Node

Fig. 4

(b) Convert the voltage source of Fig. 5 into an equivalent current source. 3

Fig. 5

8. (a) Apply Superposition theorem to find the value of current "I" in the network shown in Fig. 6. 6

Fig. 6

(b) A pure resistance of 50Ω is in series with a pure capacitance of $100\,\mu F$. The series combination is connected across 100V, 50 Hz supply.

Find (a) the impedance (b) current (c) power factor. 3

9. (a) Prove using Thevenin's theorem that the current in the R_2 resistance (value is 12Ω) of the network shown in Fig. 7 is 4A. 6
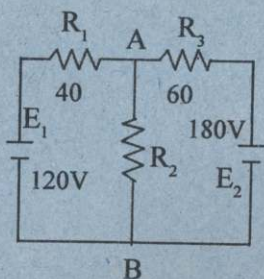

Fig. 7

(b) What do you understand by the terms active, reactive and apparent power ? 3

10. (a) Prove that the average value of H.W. Rectified Alternating Current is I_m/π. 5

(b) A resistance of 20Ω, an inductance of 0.2H and a capacitance of 100 μF are connected in series across 220V, 50 Hz mains. Determine the following (i) impedance, (ii) current, (iii) voltage across R, L and C, (iv) power in watts and VA. 4

11. Write short notes on : $3\times3=9$

(i) Maximum power transfer theorem

(ii) Resonant frequency

(iii) Form and peak factor.