Total No. of printed pages = 7

BASIC ELECTRICAL CIRCUITS

Full Marks – 70

Time – Three hours

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

Instruction :

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

PART – A

Marks – 25

1. Choose the correct answer : 1×5=5

   (i) In a series circuit, which of the parameters remain constant across all circuit elements such as resistor, capacitor and inductor etc ?

   (a) Voltage

   (b) Current

   (c) Both voltage and current

   (d) Neither voltage nor current

[Turn over

(ii) What happens to the current in the series circuit if the resistance is halved ?

(a) It becomes half its original value

(b) It becomes double its original value

(c) It becomes zero

(d) It becomes infinity

(iii) Kilowatt-hour(kWh) is a unit of

(a) Current (b) Power

(c) Energy (d) Resistance

(iv) What is the total capacitance when two capacitors C1 and C2 are connected in parallel ?

(a) (C1+C2)/C1C2

(b) 1/C1+1/C2

(c) C1C2/(C1+C2)

(d) C1+C2

(v) The value of a given waveform at any instant time is termed as _____.

(a) Waveform (b) Instantaneous value

(c) Cycle (d) Period

2. Read the following statements. Write TRUE or FALSE against each : 1×10=10

(a) A source transformation is unilateral because a voltage source cannot be converted to a current source.

(b) When there is a break in any part of a circuit, that part is said to be Open circuited.

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

(d) Resistivity of a wire depends on its cross sectional area only.

(e) In the colour code for resistances black colour represents the number 0.

(f) The Norton current is sometimes called the shorted-load current.

(g) Maximum power is transferred if load resistance is equal to internal resistance of the source.

(h) when the number of valence electrons of an atom is less than 4, the material is usually an insulator.

(i) One henry is the value of self-inductance in a closed circuit or coil in which one volt is produced by a variation of the inducing current of one ampere per second.

(j) The form factor of an alternating current waveform is the ratio of the RMS (root mean square) value to the average value.

3. Fill in the gaps : 1×10=10

(a) If a 100 Watts Bulbs ON for 10 hours, then the amount of consumed electricity is _____ kW.

(b) In case of Inductive circuit, frequency is _____ proportional to the inductance (L) or inductive reactance (X_L).

(c) In case of Capacitive circuit, frequency is _____ proportional to the Capacitance (C) or Capacitive reactance (X_C).

(d) If current and voltage are 90 degree out of phase, then the power (P) will be _____.

(e) Average value of a sinusoidal alternating signal is _____ for a full cycle.

(f) Form Factor for a sinusoidal waveform is _____.

(g) In a DC circuit, inductive reactance would be _____.

(h) Cramer's rule is used to determine value of circuit parameters using _____.

(i) _____ is the unit of inductance.

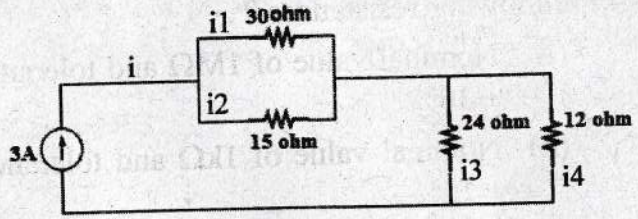
(j) If the resistors of star connected system are R1, R2, R3 then the resistance between 1 and 2 in delta connected system will be _____.

PART – B

Marks – 45

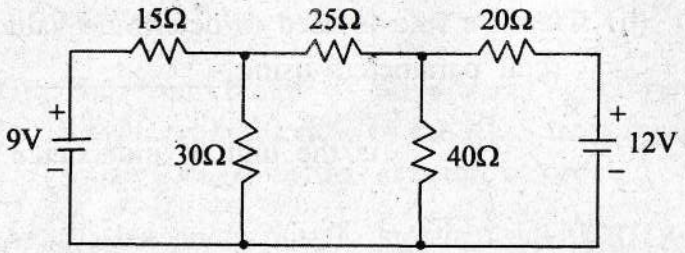
Answer any *five* questions.

4. (a) Find i1, i2, i3 and i4. 6



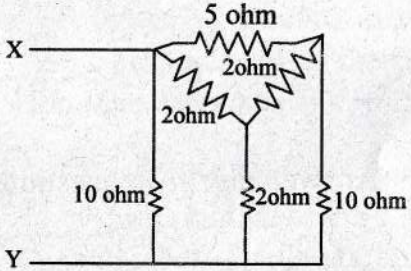
(b) State and explain Kirchhoff's laws. 3

5. Find the current flowing through the 25 ohm resistance in the circuit configuration of the figure below, using the Nodal methods : 9



6. Verify the answer of the previous question [Q2] using Mesh analysis method. 9

7. Calculate the resistance between the terminals X and Y using delta to its equivalent star conversion. 9



8. (a) What colour bands will be found on the following resistances ? 6

(i) Nominal value of 1MΩ and tolerance of ± 10%

(ii) Nominal value of 1kΩ and tolerance of ± 10%

(iii) Nominal value of 10kΩ and tolerance of ±5%

(b) When 2kΩ load is connected across a 25mA current source, it is found that only 20mA current flows in the load. Find out the internal resistance of the source. 3

9: (a) Define the following terms of an alternating quantity : 4

* rms value,
* peak factor,
* average value,
* phase.

(b) In a pure resistive circuit the instantaneous voltage and current are given by :

$v = 125 \sin 314t$; $i = 6.5 \sin 314t$

Determine the peak power and the average power. 5

10. (a) Prove that for a sinusoidal current : 5

$I_{avg} = 0.637 I_m$

(b) Prove that power absorbed in a pure inductor in an AC circuit is zero. 4