

Time : 3 Hours

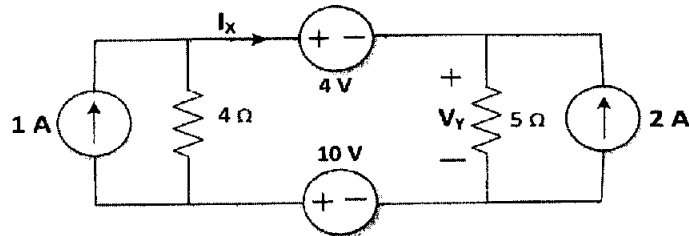
Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

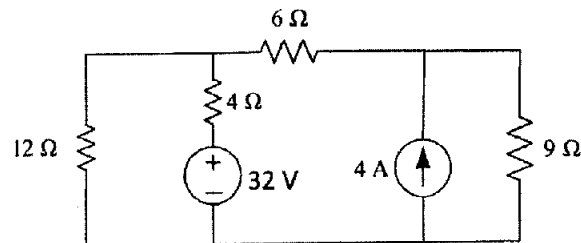
Note: Attempt five questions in all, selecting one question from each from section A, B, C and D. Section E is compulsory.

SECTION A

1. Solve the circuit using nodal analysis (figure of circuit shown below) and find I_x and V_y . (10)



2. Compute the power dissipated in the 9Ω , resistor shown in figure below by applying the superposition principle. The voltage and current sources should be treated as ideal sources. (10)



SECTION B

3. Define RMS and average value of an alternating quantity and hence show that form factor for a sine wave is 1.11. Also, derive the expression for instantaneous value of the sum and difference of the two alternating voltages are represented respectively by

$$V_1 = 60 \sin \theta \text{ volts and } V_2 = 40 \sin \left(\theta - \frac{\pi}{3} \right) \text{ volts.} \quad (10)$$

4. Discuss the benefits of 3 phase system over 1 phase system. Also, establish the relationship between line and phase voltages and currents in a 3-phase star connected balanced circuit. Show the vector diagram neatly. [10]

SECTION C

5. Discuss the differences between moving iron and PMMC type instruments. Also, derive the torque equation for permanent magnet moving coil instrument. [10]
6. (a) State Ampere's circuital law. (3)
- (b) A closed magnetic circuit of cast steel contains a 6 cm long path of cross-sectional area 1 cm^2 and a 2 cm path of cross-sectional area 0.5 cm^2 . A coil of 200 turns is wound around the 6 cm length of the circuit and a current of 0.4 A flows. Determine the flux density in the 2 cm path, if the relative permeability of the cast steel is 750. [7]

SECTION D

7. Explain the working principle of a transformer and show its equivalent circuit. Also, write a detailed note on single phase autotransformer. [10]
8. With the help of neat diagram explain the construction and working of DC Motor. Also, state the condition which determines if a dc machine is generator or motor. [10]

[P.T.O.]

Section E (Attempt all questions)

9. (a) What is the function of moderator used in nuclear reactor?
Name the two moderators commonly used in nuclear power reactor. [2]
- (b) Differentiate between ideal and practical voltage sources. [2]
- (c) Define form factor and peak factor of an alternating quantity. [2]
- (d) What are the basic requirements of fuses? [2]
- (e) Three loads, each of resistance 30 ohms, are connected in star to a 415 V, 3-phase supply. Determine (i) the system phase voltage, (ii) the phase current and (iii) the line current. [2]
- (f) State the advantages and disadvantages of PMMC instruments. [2]
- (g) Define Magnetic flux and Flux density. [2]
- (h) Why transformers are rated in kVA? [2]
- (i) What is back emf in dc motors? [2]
- (j) List three types of damping employed in electrical instruments. [2]