21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. Attempt any FIVE of the following : **10**

(a) Draw power triangle for R-C series circuit. State the nature of power factor of this circuit.

(b) Draw a phasor diagram for series R-L circuit showing supply voltage V, supply current I, voltage across resistor V_R & voltage across inductor V_L.

(c) What is current magnification in parallel R-L-C circuit.

(d) Define : Phase sequence and write equations for instantaneous values of 3-ph voltages.

(e) Distinguish clearly between loop and mesh.

(f) State Thevenin's theorem.

(g) State Reciprocity theorem.

2. Attempt any THREE of the following : **12**

(a) An AC series circuit consisting of R = 15 Ω, L = 0.1 H and C = 80 μF is supplied from 230 V, 50 Hz power supply. Determine :

(i) Impedance of circuit

(ii) Current drawn by the circuit

(iii) Circuit power factor

(iv) Reactive power drawn by circuit

(b) An AC circuit consists of two branches in parallel.
Branch I : R = 10 Ω and L = 0.1 H in series.
Branch II : C = 50 μF.
If the circuit is supplied form 200 V, 50 Hz supply, determine :
(i) Branch impedances.
(ii) Branch currents
(iii) Circuit power factor
(iv) Power consumed by the circuit

(c) A star connected 3-ph load is supplied from 3-ph, 415 V, 50 Hz supply. If the line current is 20 A and total power taken from supply is 10 kW, then determine :
(i) Load resistance and reactance per phase.
(ii) Load power factor
(iii) Total 3-phase reactive power

(d) Using Node analysis, find current I in the circuit shown in Fig. No. 1.

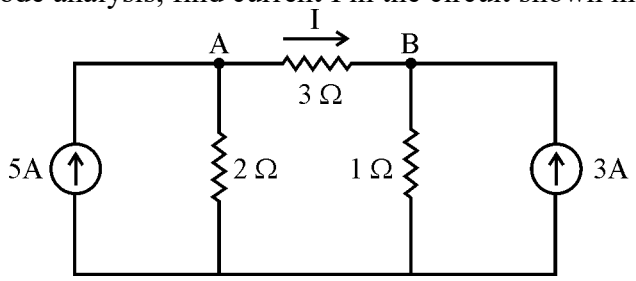

Fig. No. 1

3. Attempt any THREE of the following : **12**

(a) A series R-L-C circuit consists of R = 15 Ω, L = 0.5 H and C = 25 μF. If the circuit is supplied from 230 V, 50 Hz Ac supply, determine :
(i) Circuit power factor
(ii) Active power
(iii) Reactive power
(iv) Apparent power

(b) Two parallel impedances $Z_1 = (10 + j8)\ \Omega$ and $Z_2 = (15 - j10)\ \Omega$ are connected to 230 V, 50 Hz AC supply. Using admittance method, calculate branch currents, total current and power factor of whole circuit.

(c) Explain 'Neutral Shift' in case of 3-phase star-connected unbalanced load.

(d) With neat circuit diagram, explain how to convert voltage source into current source and vice-versa.

(e) Using Mesh analysis, find current I in the circuit shown in Fig. No. 2.

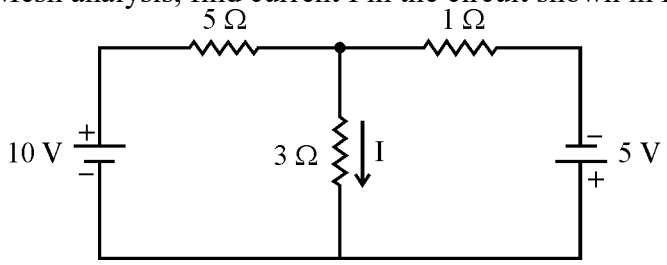

Fig. No. 2

4. Attempt any THREE of the following : **12**

(a) An inductive coil having resistance of 5 Ω and inductance of 0.2 H is connected in series with a capacitor of 20 μF. If this combination is connected to 230 V, variable frequency supply, determine :
  (i) Resonant Frequency
  (ii) Quality factor
  (iii) Current at resonance
  (iv) Voltage across inductive coil at resonance

(b) A coil having resistance of 10 Ω and inductance of 0.15 H is connected in parallel with R-C series combination having R= 5 Ω & C = 20 μF. If supply voltage is 110 V, 50 Hz, then
  (i) Draw circuit diagram
  (ii) Calculate branch currents using impedance method
  (iii) Power absorbed by the coil

(c) Three equal impedances having R = 20 Ω in series with C = 50 μF, are connected in delta across 415 V, 3-ph, 50 Hz AC supply. Determine :
  (i) Impedance per phase
  (ii) Phase and line currents
  (iii) Total 3-ph power consumed by load

(d) With neat circuit diagram, explain the concept of duality in Electric circuit. State any four examples (pairs) of duality in electric circuit.

5. Attempt any TWO of the following : **12**

(a) An inductive coil having resistance of 10 Ω and inductance of 0.5 H is connected in parallel with a capacitor of 50 μF. Determine :
  (i) Parallel resonant frequency
  (ii) Quality factor of parallel circuit
  (iii) Power consumed by circuit at resonance, if the supply voltage is 230 V.

P.T.O.

(b) Reduce the network shown in Fig. No. 3 by applying Star/Delta or Delta/Star transformation and determine equivalent resistance R_{AB}.

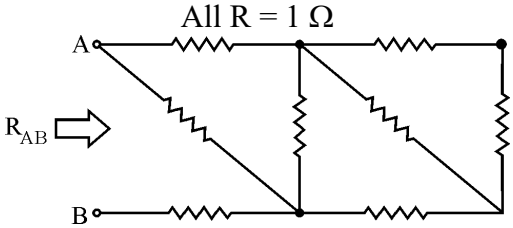

Fig. No. 3

(c) For network shown in Fig. No. 4, determine value of R so that maximum power is delivered to it. Also compute the maximum power delivered.

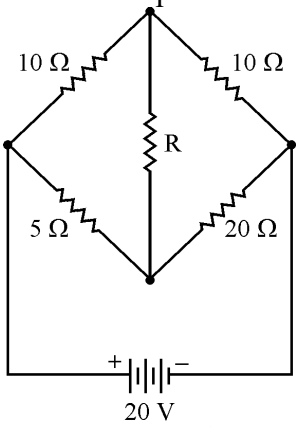

Fig. No. 4

6. Attempt any TWO of the following : **12**

(a) A series RLC circuit consists of R = 10 Ω, L = 0.5 H and C = 20 μF, is connected to 230 V, variable frequency supply. Determine :
- (i) Resonant frequency
- (ii) Voltage magnification
- (iii) Current drawn by circuit
- (iv) Voltage across each element
- (v) Power factor at resonance
- (vi) The power consumed at resonance

(b) Draw complete phasor diagram of voltages & currents for balanced delta-connected load, and prove the relationship between :
- (i) Line current & phase current
- (ii) Line voltage & phase voltage

(c) Apply superposition theorem to compute current I in the network shown in Fig. No. 5.

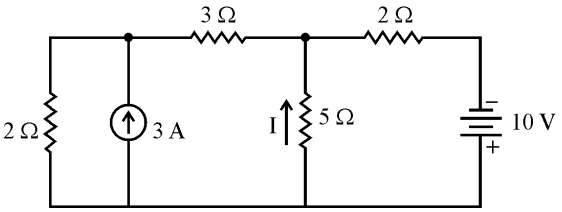

Fig. No. 5