Code : 031101

2012

BASIC ELECTRICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Answer any *seven* of the following : 2×7=14

(a) What are the basic electrical elements? Write *V-I* relationship for each of them.

(b) State Ohm's law. What are its limitations?

(c) Explain different types of dependent sources.

(d) State the maximum power transfer theorem.

(e) Define RMS value, average value, form factor and peak factor.

(f) Write the properties of resonance of series *R-L-C* circuit.

(g) Define balanced load. Give the line and phase relationship for voltage and current in a star-connected three-phase circuit.

(h) What are the main losses that occur in ferromagnetic core materials? Also write the formula to calculate them.

(i) Why should ammeter always be connected in series with the circuit? Define sensitivity of voltmeter.

(j) Define quality factor. How will you correlate bandwidth, resonant frequency and quality factor?

2. *(a)* State Thevenin's theorem and give the procedure for thevenizing a circuit. Mention its limitations. 6

(b) Determine the current in the 1 Ω branch in the circuit shown in Fig. 1. Use mesh method. 8

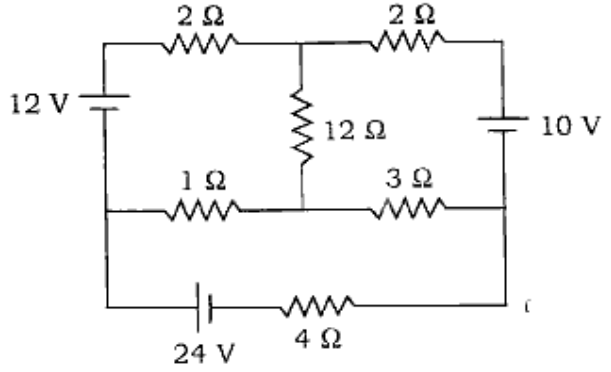

Fig. 1

3. *(a)* Find V_L in the circuit of Fig. 2 using superposition theorem. 6

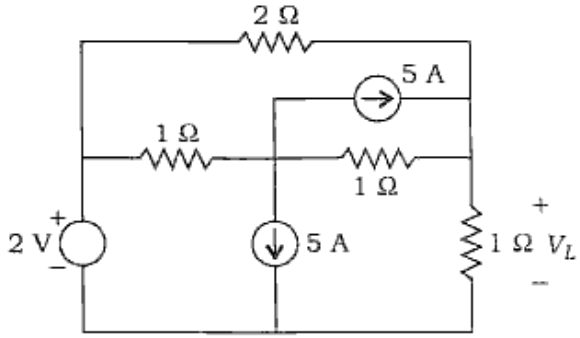

Fig. 2

(b) Find the current through 1·6 Ω resistor in the circuit of Fig. 3 using Norton's theorem. 8

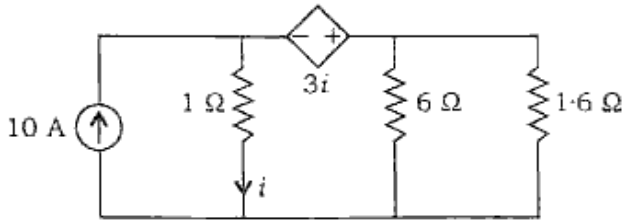

Fig. 3

4. *(a)* The inductive reactance in series with Z in the circuit of Fig. 4 has a value of 25 Ω. If the voltage drop across Z is 179 volts, the power dissipated in the circuit is 320 W.

(i) Find the p.f. of the circuit.

(ii) Find the circuit resistance.

(iii) Find the inductive part of Z.

(iv) What is the value of net reactive power drain? 8

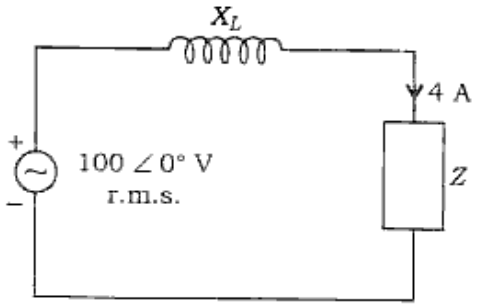

Fig. 4

(b) Show that the active power over a complete cycle is zero for a purely inductive circuit. 6

5. *(a)* Explain two wattmeters of power measurement. Mention different cases also. 6

(b) Find the real power delivered by the source in Fig. 5. 8

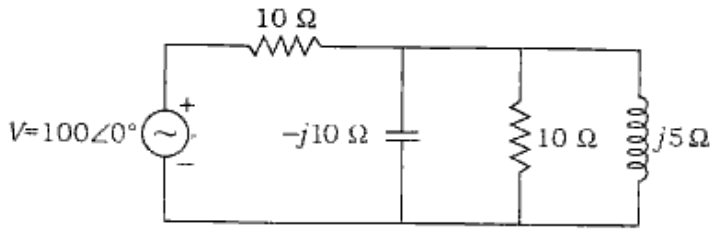

Fig. 5

6. *(a)* Two impedances $Z_1 = 5 \angle -30° \Omega$ and $Z_2 = 10 \angle 45° \Omega$ are connected in parallel. The combination draws $(2 + j4)$ A current from a voltage source. Determine the voltage source and the complex power for each branch. 6

(b) A heater takes 10 A at 50 V. Calculate the impedance of a choke of 5 Ω resistance to be placed in series with it in order that it may work at 200 V, 50 Hz supply. Find also the power factor of the circuit. 8

7. *(a)* A delta-connected load in Fig. 6 has the following impedances :

$$Z_{RY} = j10\ \Omega,\ Z_{YB} = 10 \angle 0° \Omega,$$
$$Z_{BR} = -j10\ \Omega$$

If the load be connected across a three-phase 100 V supply (balanced), obtain the line currents and also draw the phasor diagram. 8

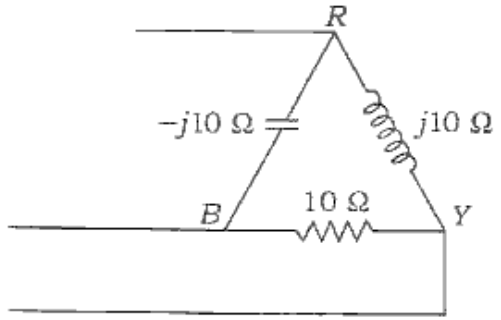

Fig. 6

(b) In an *R-L-C* series circuit the resistance, inductance and capacitance are 10 Ω, 100 mH and 10 microfarad. Calculate ω_0, ω_1 and ω_2. Also find BW and selectivity. (The terms have their usual meanings.) 6

8. A magnetic core, in the form of a closed ring has a mean length of 20 cm and a cross-section of 1 cm^2. The relative permeability of iron is 2400. What direct current will be needed in a coil of 2000 turns uniformly wound round the ring to create a flux of 0·2 mWb in the iron? If an air gap of 1 mm is cut through the core perpendicular to the direction of this flux, what current will now be needed to maintain the same flux in this gap? 14

9. *(a)* What are the different moving-coil instruments? Explain any one in detail. 8

(b) Explain in brief different types of controlling torque in an indicating instrument. 6

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