Code : 031101

B.Tech 1st Semester Exam., 2017

BASIC ELECTRICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

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

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

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

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

1. Write short notes on any *seven* of the following terms : 2×7=14

(a) Linear elements

(b) Magnetic coupling

(c) Ohm's law

(d) Node and mesh analysis

(e) Q-factor

(f) Bilateral elements

(g) Dependent sources

(h) Current and voltage measurement

(i) Peak factor of sine wave

(j) Behaviour of inductance in DC circuit

2. *(a)* What is the magnitude of the current drained from the 10 volts source in Fig. 1? 7

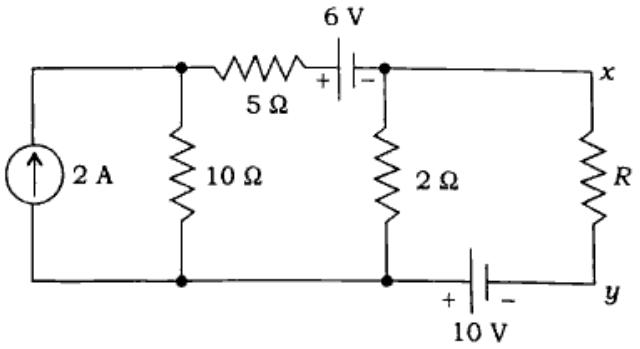

Fig. 1

(b) With reference to Fig. 2 below, determine the voltage appearing across terminals *y-z*, if a d.c. voltage of 100 volts is applied across *x-y*. 7

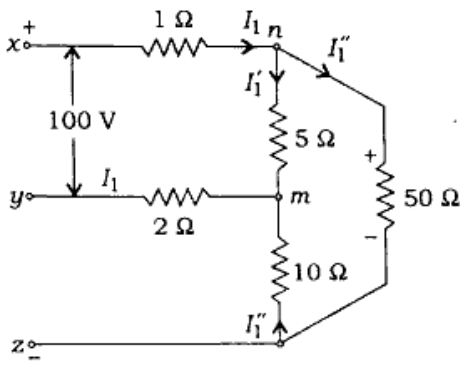

Fig. 2

3. (a) In the circuit given in Fig. 3, find the power loss in the 1Ω resistor by Thevenin's theorem : 6

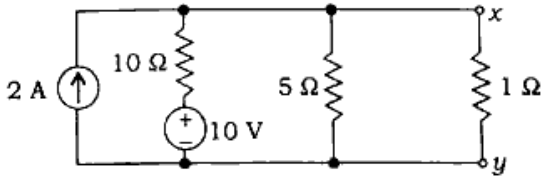

Fig. 3

(b) Find Norton's equivalent to the right of *a-b* terminals in Fig. 4 : 8

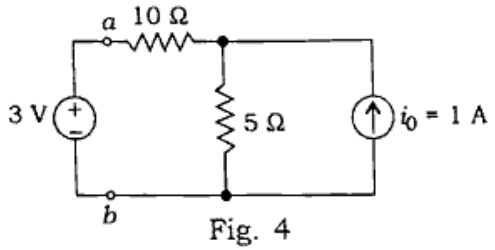

Fig. 4

4. (a) Find *I* in the circuit shown in Fig. 5 : 6

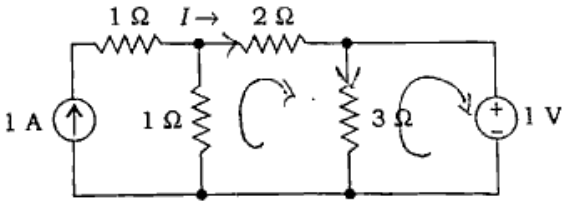

Fig. 5

(b) Find *R* to have maximum power transfer in the circuit of Fig. 6. Also obtain the amount of maximum power. 8

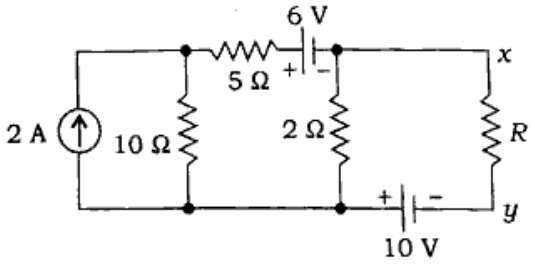

Fig. 6

5. *(a)* A 4 Ω resistor is connected to a 10 mH inductor across a 100 V, 50 Hz voltage source. Find the *(i)* impedance of the circuit, *(ii)* input current, *(iii)* drop across the resistor and inductor, *(iv)* power factor of the circuit, *(v)* real power consumed in the circuit and *(vi)* total power supplied. 6

(b) A series *R-L-C* circuit has inductance of 10 mH and resistance of 2 Ω. What is the value of capacitance that will produce resonance? Also find the current at resonance frequency and maximum instantaneous energy stored in the inductance at resonance. Assume the supply as 230 V, 10000 Hz sinusoidal. 8

6. *(a)* A 3-phase balanced system supplies 110 volts to a delta-connected load whose phase impedances are equal to $(3 \cdot 54 + j3 \cdot 54)\,\Omega$. Determine the line currents and draw the phasor diagram. 6

(b) Three identical impedances $(R + jX_L)$ are connected in the form of a star against a 415 V (line-line) 3-phase voltage source and drawing a total power of 1·8 kW. Obtain the resistive and reactive components of each phase impedance. Assume the line current to be 10 A. 8

7. *(a)* Where and how an ammeter or a voltmeter is connected in a circuit? Discuss two methods for current measurement and two methods for voltage measurement. 6

(b) Discuss about a suitable AC power measurement device with neat diagram and clear nomenclature. 8

8. Derive the mathematical expression of total inductance in series-connected coupled coils—

(a) when flux of both the coils are mutually assisting;

(b) when flux of both the coils are mutually opposing. 14

9. Find the total inductance of the three series-connected coupled coils for the circuit shown in Fig. 7 : 14

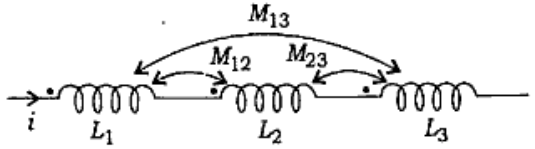

Fig. 7

Given that $L_1 = 1\text{H}$; $L_2 = 2\text{H}$; $L_3 = 5\text{H}$; $M_{12} = 0 \cdot 5\text{H}$; $M_{23} = 1\text{H}$; $M_{13} = 1\text{H}$.

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