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Question Paper Code : 97063

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Second Semester

Electronics and Communication Engineering

EE 6201 — CIRCUIT THEORY

(Common to Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Instrumentation Engineering, Biomedical Engineering and Medical Electronics Engineering)

(Regulation 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. An electrical appliance consumes 1.2 kWh in 30 mins at 120 V. What is the current drawn by the appliance?

2. Calculate the equivalent resistance between the terminals "*a*" and "*b*", in Fig. 1.

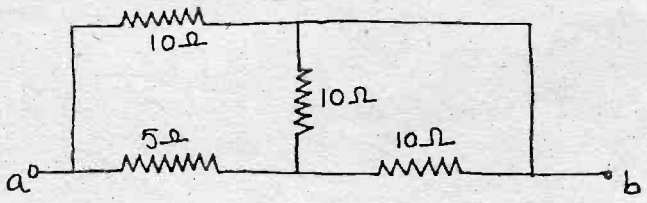

Fig. 1

3. Calculate the value of I_N for the circuit shown in Fig. 2.

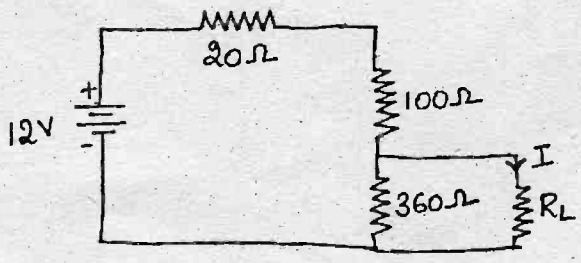

Fig. 2

4. State maximum power transfer theorem for DC networks.

5. Calculate the total inductance of the circuit, if the coefficient of coupling (k) between the two coils is 0.6, as shown in Fig. 3.

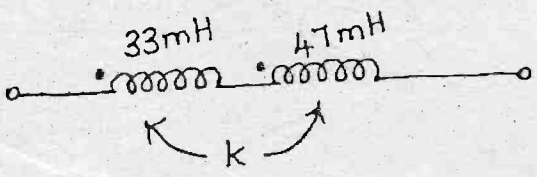

Fig. 3

6. Define quality factor of a series resonant circuit.

7. A coil of resistance 2.2 Ω and an inductance 0.01 H is connected in series with a capacitor across 220 V mains. Find the value of capacitance such that maximum current flows in the circuit at a frequency of 190 Hz. Also find the maximum current.

8. A 50 μF capacitor is discharged through a 100 kΩ resistor. If the capacitor is initially charged to 400 V, determine the initial energy.

9. Write the equations for the phasor difference between the potentials of the delta connected networks.

10. Three coils, each having a resistance of 20 Ω and an inductive reactance of 15 Ω are connected in star to a 400 V, 3-phase, and 50 Hz supply. Calculate (a) the line current, (b) power factor, and (c) power supplied.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Using node analysis, find the node voltages and the currents through all the resistors for the circuit shown in Fig. 4. (12)

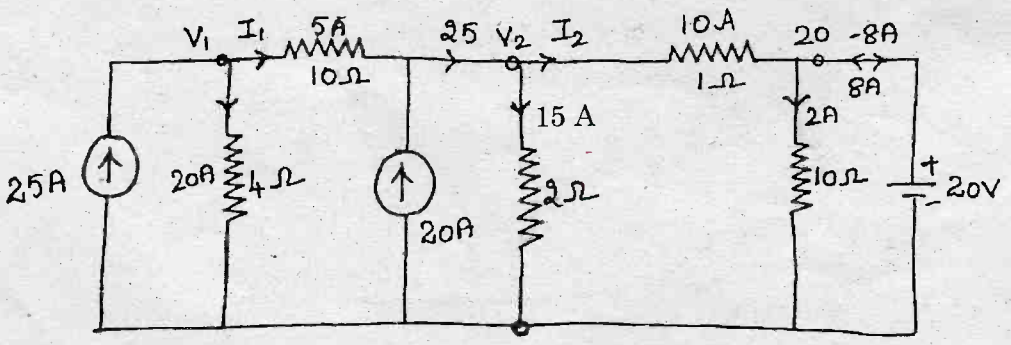

Fig. 4

(ii) Find the equivalent resistance between the terminals '*a*' and '*b*' for the network shown in Fig. 5. (4)

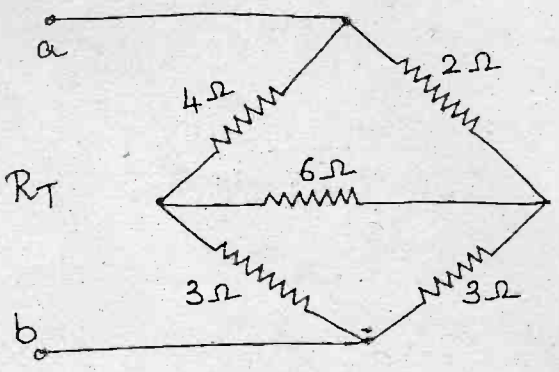

Fig. 5

Or

(b) For the circuit shown in Fig. 6, find the (i) currents in different branches, (ii) current supplied by the battery, (iii) potential difference between terminals A and B. (16)

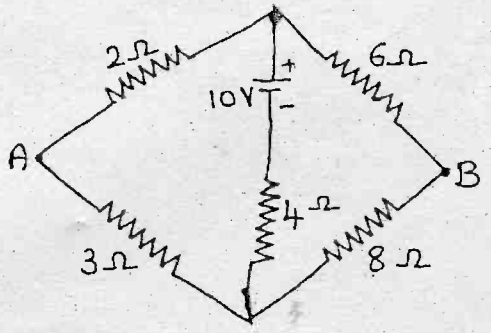

Fig. 6

12. (a) Find the current *I*, through the 20 Ω resistor shown in Fig. 7 using Thevenin's theorem. (16)

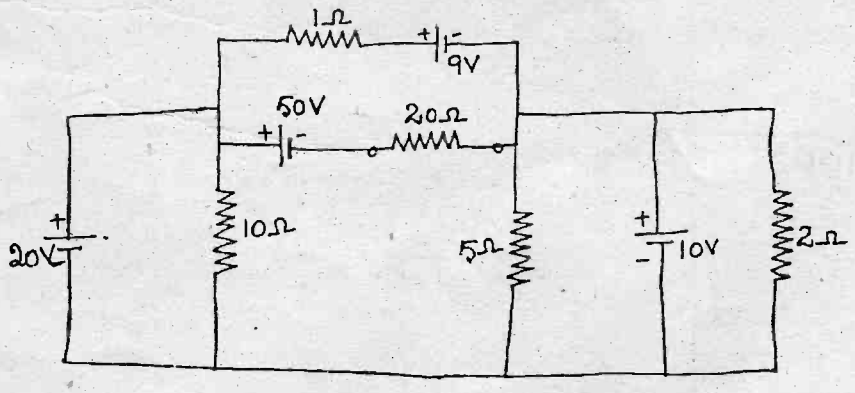

Fig. 7

Or

(b) Find the current through 5 Ω resistor using superposition theorem, in the circuit shown in Fig. 8. (16)

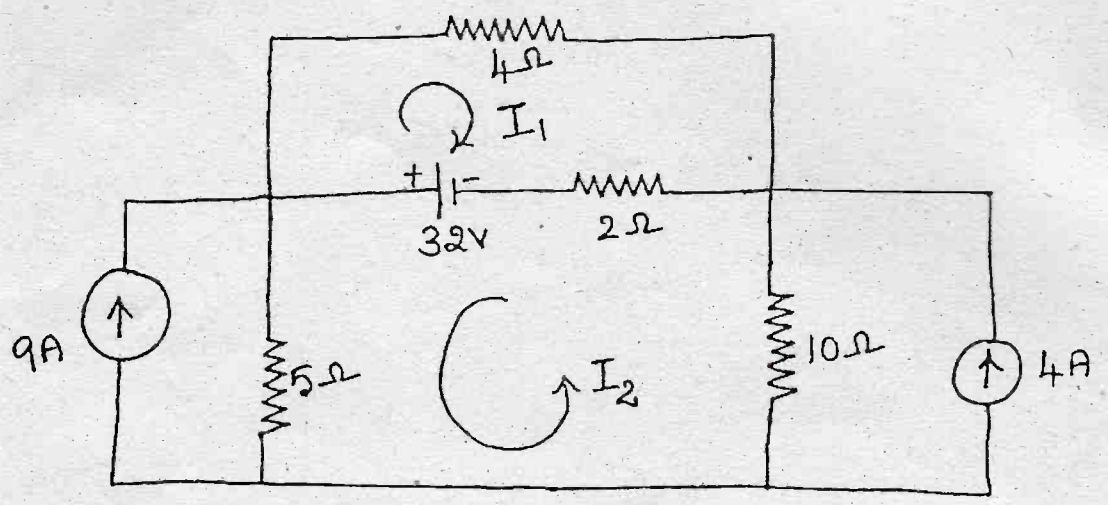

Fig. 8

13. (a) Impedance Z_1 and Z_2 are parallel and this combination is in series with an impedance Z_3, connected to a 100 V, 50 Hz ac supply. $Z_1 = (5 - jX_c)\Omega$, $Z_2 = (5 + j0)\Omega$, $Z_3 = (6.25 + j1.25)\Omega$. Determine the value of capacitance such that the total current of the circuit will be in phase with the total voltage. Find the circuit current and power. (16)

Or

(b) The switch in the circuit shown in Fig. 9 is moved from position 1 to 2 at $t = 0$. Find the expression for voltage across resistance and capacitor, energy in the capacitor for $t > 0$. (16)

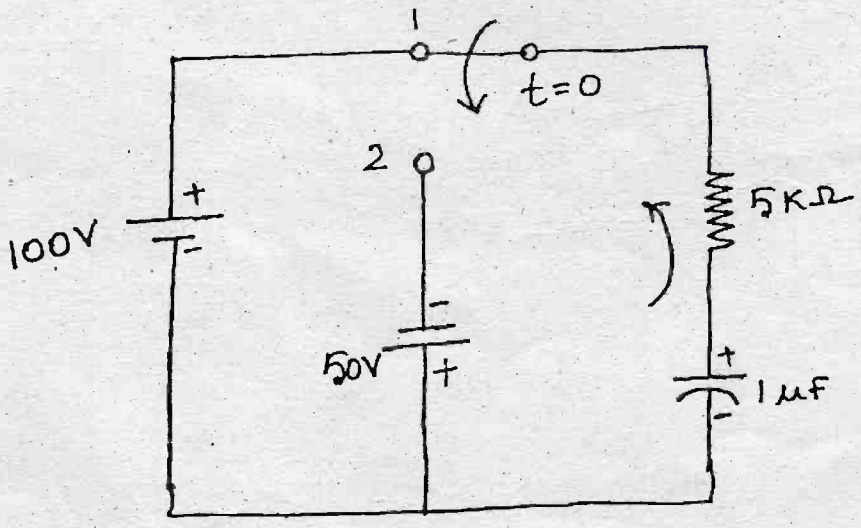

Fig. 9

14. (a) (i) For a magnetically coupled circuit, derive the expression for mutual inductance (M) in terms of L_1 and L_2. (6)

(ii) For the coupled circuit shown in Fig. 10, find the value of V_2 so that the current $I_1 = 0$. (10)

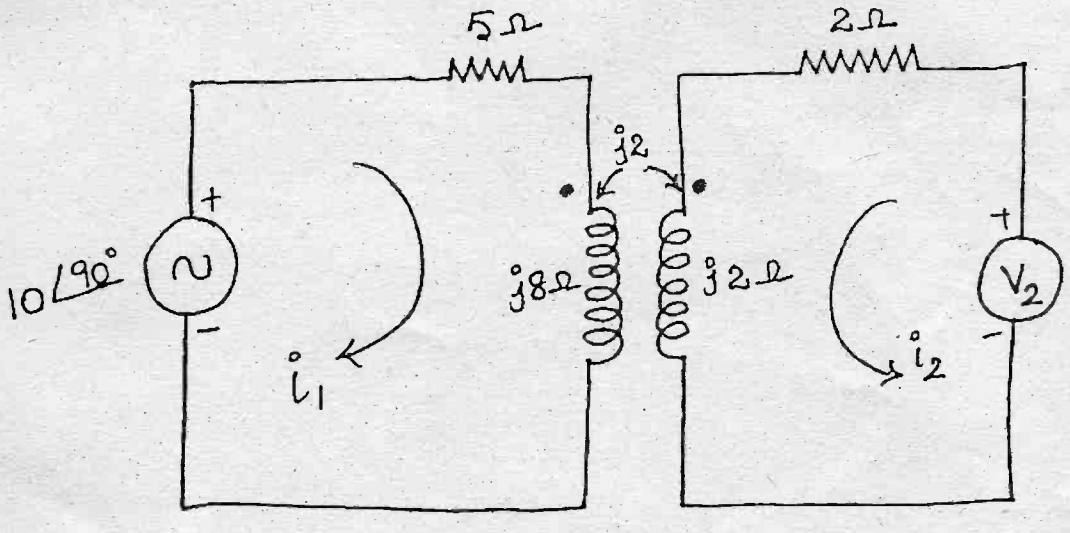

Fig. 10

Or

(b) With neat illustration, describe the parallel resonant circuit and the equivalent parallel network for a series RL combination. Also derive the unity power factor, f_p. (16)

15. (a) Show that three phase power can be measured by two wattmeters. Draw the phasor diagrams. Derive an expression for power factor interms of wattmeter readings. (16)

Or

(b) (i) A 400 V (line to line) is applied to three star connected identical impedances each consisting of a 4 Ω resistance in series with 3 Ω inductive reactance. Find (1) line current and (2) total power supplied. (8)

(ii) Three star-connected impedances $Z_1 = (20 + j37.7)\ \Omega$ per phase are in parallel with three delta-connected impedance $Z_2 = (30 - j159.3)\ \Omega$ per phase. The line voltage is 398 volts. Find the line current, power factor, power and reactive volt-ampere taken by the combination. (8)
