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Question Paper Code : 51006

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Second Semester

Electrical and Electronics Engineering

EE 3251 – ELECTRIC CIRCUIT ANALYTICS

(Common to Electronics and Instrumentation Engineering and Instrumentation and Control Engineering)

[Also common to PTEE 3251 – Electric Circuit Analytics for B.E. (Part –time) Second Semester – Electrical and Electronics Engineering – Regulations 2023]

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine the voltage across 20Ω resistor of the network shown in Fig. 1,

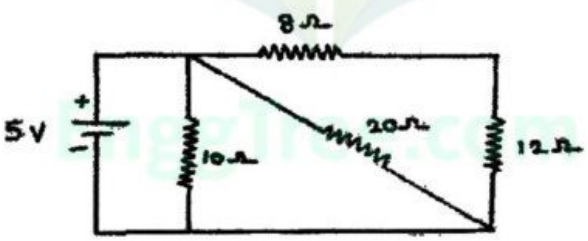

Fig.1

2. A 60-W incandescent bulb operates at 120 V. How many electrons and coulombs flow through the bulb in one day?
3. Write the condition for maximum power transfer in alternating current circuits, if the load consists of a purely variable resistance.
4. State Norton's theorem.
5. Define time constant of RL circuit.
6. In a series RLC circuit if R = 10 Ω, L = 5H and C = 2mF, find Neper frequency and resonant frequency.
7. Two coupled coils with the self inductances 50 mH and 200 mH have a coupling coefficient of 0.5. Find the value of its mutual inductance.

8. Write the formula for calculating Q-factor of a parallel resonant circuit.

9. Two wattmeter method is used for power measurement in a three phase circuit. If the power factor is unity, what could be its effect on wattmeter readings?

10. Write two important advantages of 3 phase systems.

PART B — (5 × 13 = 65 marks)

11. (a) Using nodal analysis, determine the voltages at each node of the circuit shown in Fig. 11(a).

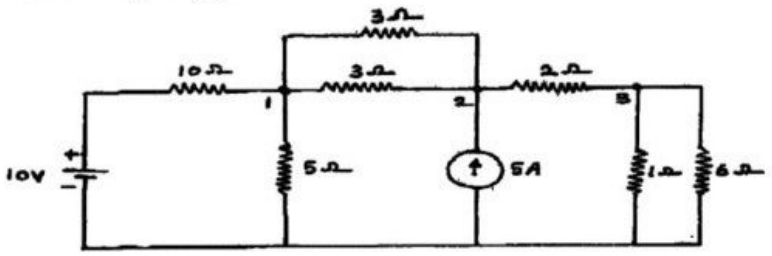

Fig. 11(a).

Or

(b) For the circuit in Fig. 11(b), Find the branch currents I_1, I_2, I_3 using mesh analysis.

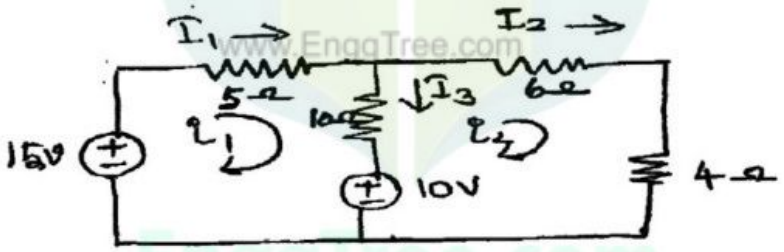

Fig. 11(b)

12. (a) Obtain the Norton equivalent for the circuit shown in Fig. 12(a) and hence determine the current through the load resistance.

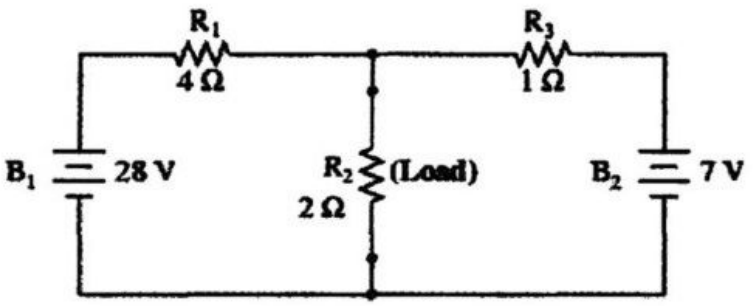

Fig. 12(a)

Or

(b) Calculate I_0 in the circuit shown in Fig. 12(b).

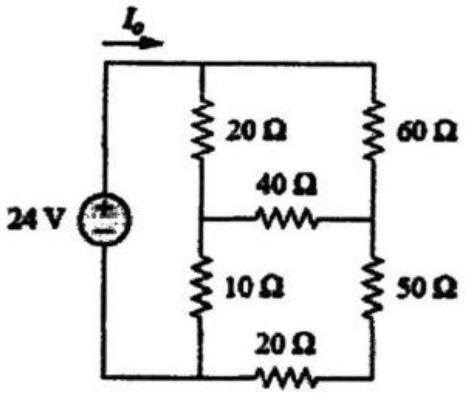

Fig. 12(b)

13. (a) Find i(t) in the circuit shown in Fig. 13(a) for t > 0. Assume that the switch has been closed for a long time.

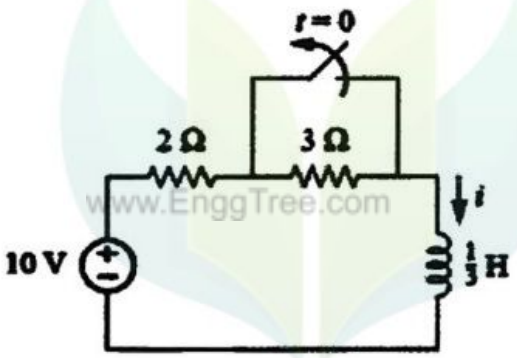

Fig. 13(a)

Or

(b) A series RC circuit consists of resistor of 10 Ω and capacitor of 0.1 F connected to a constant voltage of 20 V through a switch S. Assume that the switch is closed at t = 0, obtain the current equation and determine the voltages across the resistor and capacitor.

14. (a) A voltage v (t) = 10 sin ωt is applied to a series RLC circuit. At resonant frequency of the circuit, the maximum voltage across the capacitor is found to be 500 V. Also the bandwidth is 400 rad/sec and impedance at resonance is 100 Ω. Find the resonant frequency. Also find the values of L and C of the circuit.

Or

(b) A coil having a resistance of 10 Ω and an inductance of 125 mH is connected in series with a 60 μF capacitor across a 120 V supply. At what frequency does resonance occur? Find the current flowing at the resonant frequency.

15. (a) A star-connected system has a balanced voltage of 440 V, the load impedances are Z1 = (3 + j2) Ω, Z2 = (4 + j5) Ω and Z3 = (6 + j3) Ω. Determine the phase voltages for a unbalanced star-connected load.

Or

(b) An unbalanced four-wire, star-connected load has a balanced voltage of 400V, the loads are Z1 = (4 + j8) Ω, Z2 = (3 + j4) Ω and Z3 = (15 + j20) Ω. Calculate the line currents, current in the neutral wire and the total power.

PART C — (1 × 15 = 15 marks)

16. (a) Find the equivalent resistance across the terminals A and B of the network shown in Fig. 16(a), using star-delta transformation.

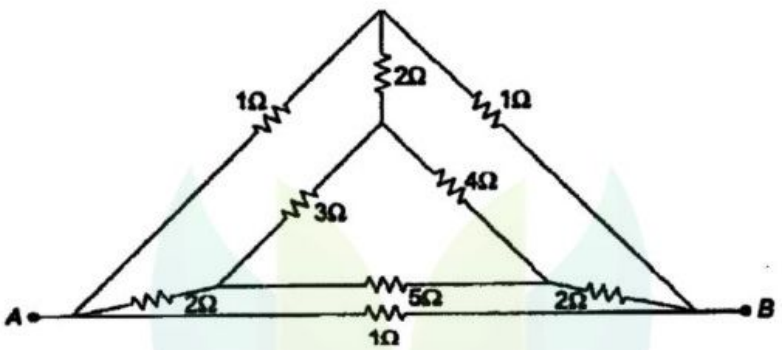

Fig. 16(a)

Or

(b) Find the currents I_1, I_2, I_3 for the circuit shown in Fig. 16(b).

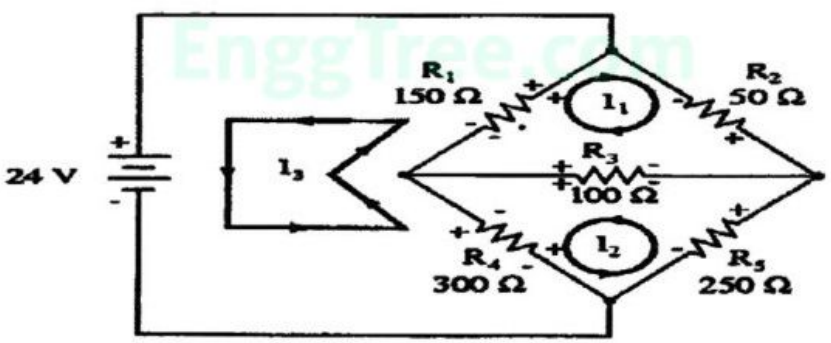

Fig. 16(b)