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**Question Paper Code : 90978**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Second Semester

Electronics and Communication Engineering

EC 3251 — CIRCUIT ANALYSIS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Kirchhoff's Law.

2. Find the equivalent resistance of circuit with three resistors connected in parallel, each having a resistance value of 2 Ohms.

3. State the conditions for maximum power transfer in DC circuits.

4. State Norton theorem.

5. Define instantaneous power in an AC circuit.

6. A sinusoidal voltage is given by $v(t) = 50 \sin (100\pi t+30°)$. What are the amplitude, angular frequency, and phase angle of the signal?

7. A source-free RL circuit has $R = 5\Omega$ and L=2 H. Calculate the time constant.

8. What is the voltage across an inductor at $t = 0+$ in a source-free RL circuit?

9. Define a tree in network topology.

10. Two coils have $L_1$ = 10 mH, $L_2$=20 mH and mutual inductance M=5 mH. Calculate the coefficient of coupling (k).

PART B — (5 × 13 = 65 marks)

11. (a) Using mesh analysis calculate

(i) equivalent resistance across the terminal of the supply (7)

(ii) total current supplied by the source (3)

(iii) power delivered to 5 Ω resistors in the circuit shown in Figure 11 (a) (3)

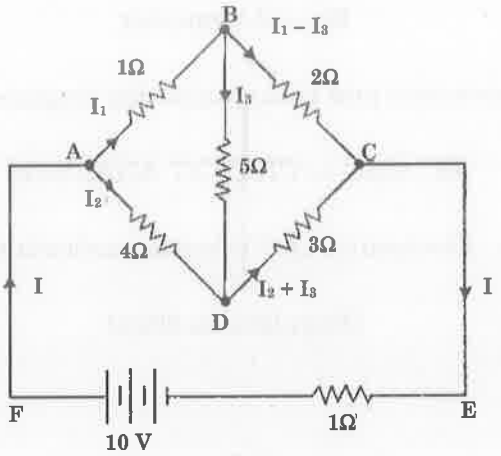


Figure 11 (a)

Or

(b) (i) A 100 watt, 250 V lamp is connected in series with a 100 watt, 200 V lamp across 250 V supply. Calculate (1) circuit current and (2) voltage across each lamp. Assume the lamp resistances to remain unaltered. (9)

(ii) Explain the features and advantages of parallel circuits. (4)

12. (a) Using superposition theorem, Estimate the current in 23 Ω resistor in the circuit shown in Figure. 12 (a)

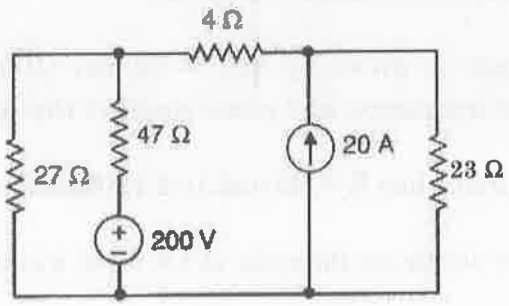


Figure. 12 (a)

Or

(b) Using Thevenin's theorem, find the current in 10 Ω resistor in the circuit shown in Figure. 12 (b)

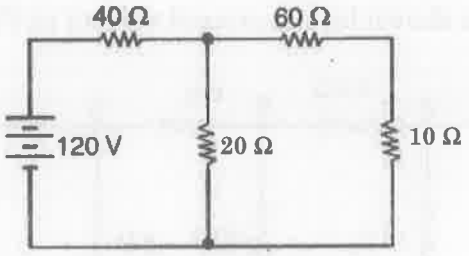


Figure. 12 (b)

13. (a) A coil having a resistance of 7W and an inductance of 31.8 mH is connected to 230 V, 50 Hz supply. Calculate

(i) the circuit current and phase angle (5)

(ii) power factor and power consumed and (4)

(iii) voltage drop across resistor and inductor (4)

Or

(b) A coil of resistance 50W and inductance 318 mH is connected in parallel with a circuit consisting of a 75W resistor in series with a 159 μF capacitor. The circuit is connected to a 230 V, 50 Hz supply. Determine the supply current and circuit power factor.

14. (a) Explain the concept of resonance in a series RLC circuit.

Or

(b) A parallel LC circuit has an inductance L = 100 μH which has a coil resistance of 12W. The capacitor C is adjustable over the range 200 pF to 300 pF. Find (i) the maximum and minimum resonance frequencies for the circuit (ii) the Q-factor and (iii) bandwidth of the circuit at the two resonance frequency extremes. (5 + 4 + 4)

15. (a) Coils A and B in a magnetic circuit have 600 and 500 turns respectively. A current of 8 A in coil A produces a flux of 0.04 Wb. If the coefficient of coupling is 02, calculate:

(i) Self-inductance of coil A, with B open-circuited. (5)

(ii) The average e.m.f. induced in coil B when the flux with it changes from zero to full value in 0.02 second. (4)

(iii) Mutual inductance. (4)

Or

(b) Explain the concept of magnetically coupled circuits with a detailed derivation of the voltage equations in terms of self-inductance ($L_1$, $L_2$) and mutual inductance (M).

PART C — (1 × 15 = 15 marks)

16. (a) Using nodal analysis, estimate the voltages at nodes A, B and C w.r.t. the reference node shown by the ground symbol in Figure . 16 (a)

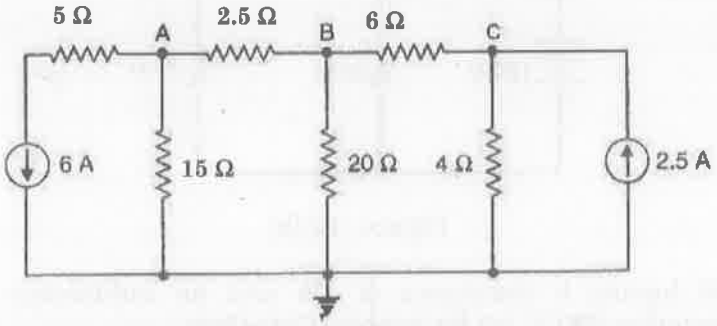


Figure. 16 (a)

Or

(b) With the help of star/delta transformation, obtain the value of current supplied by the battery in the circuit shown in Figure. 16 (b).

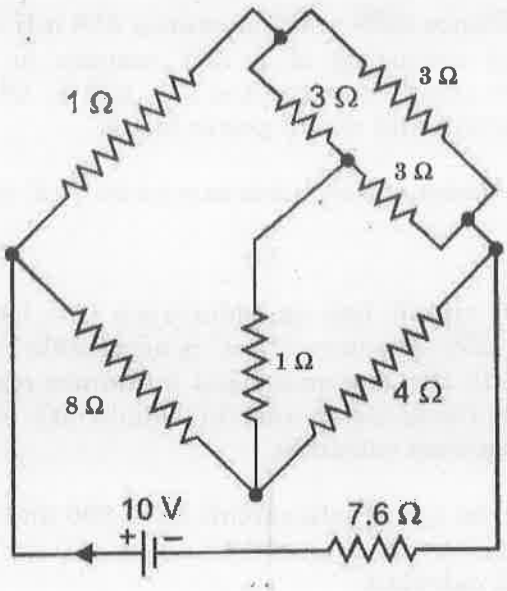


Figure. 16 (b)