Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50955

ECE - 1

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

Second Semester

Electronics and Communication Engineering

EC 3251 — CIRCUIT ANALYSIS

(Common to : Electronics and Telecommunication Engineering)

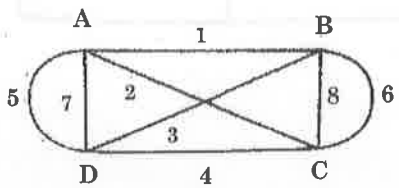
(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Kirchoff's current law.
2. Define Independent source.
3. State Maximum power transfer theorem.
4. State the dual elements for the following.
   (a) Resistance
   (b) Capacitance
   (c) Inductance
   (d) Mesh current
5. Write the expression for the total admittance of Y1 and Y2 in series and parallel combination.
6. What is the expression for average power in a single phase circuit? Explain the terms involved.
7. An RLC series circuit has R = 10Ω, XC = 62.833 Ω. Find the value of L for resonance at 50HZ.
8. Compare the series and parallel resonant circuit.
9. Define Link.
10. For the network graph shown in the figure, show a tree and the corresponding links.



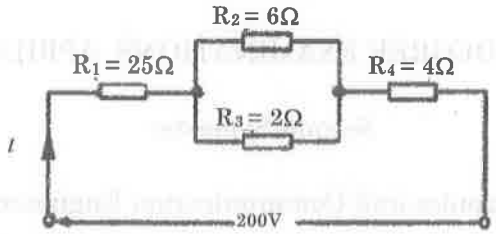
PART B — (5 × 13 = 65 marks)

11. (a) (i) For the series-parallel arrangement shown in Figure, find

(1) the supply current,

(2) the current flowing through each resistor and

(3) the potential difference across each resistor. (10)



(ii) Draw the Norton's equivalent circuit. (3)

Or

(b) (i) Three resistances of values 2Ω, 3Ω and 5Ω are connected in series across 20V, D.C Supply. Calculate

(1) equivalent resistance of the circuit

(2) the total current of the circuit

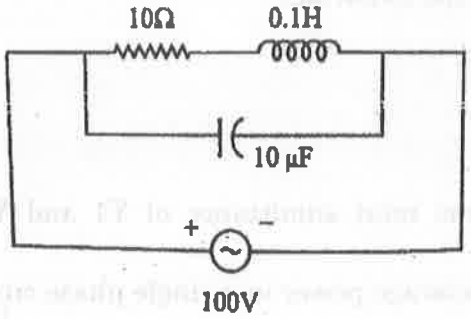
(3) the voltage drop across each resistor and

(4) the power dissipated in each resistor. (8)

(ii) A lamp can work on 50 volt mains taking 2 amps. What value of the resistance must be connected in series with it so that it can be operated from 200 volt mains giving the same power? (5)

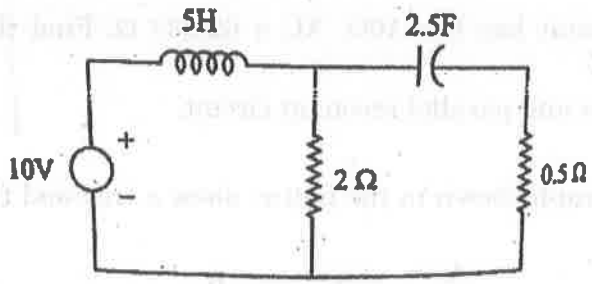
12. (a) Draw the dual network of network shown below.

(i)



(7)

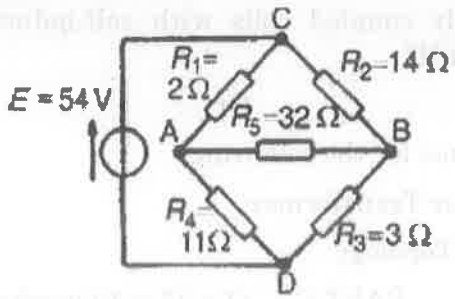
(ii)



(6)

Or

(b) (i) Wheatstone Bridge network is shown in Figure. Calculate the current flowing in the 32Ω resistor, and its direction, using Thévenin's theorem, Assume the source of e.m.f. to have negligible resistance. (10)



(ii) A star-connected load consists of three identical coils each of resistance 30 Ω and inductance 127.3 mH. If the line current is 5.08 A, calculate the line voltage if the supply frequency is 50 Hz. (3)

13. (a) A pure inductance of 1.273 mH is connected in series with a pure resistance of 30Ω. If the frequency of the sinusoidal supply is 5 kHz and the potential difference across the 30Ω resistor is 6 V, determine the value of the supply voltage and the voltage across the 1.273mH inductance. Draw the phasor diagram. (13)

Or

(b) Two impedances (15 – j10) Ω and (10 + j15) Ω are connected in parallel. The supply voltage is 200V, 50 Hz. Calculate

(i) the admittance,

(ii) conductance,

(iii) susceptance of the combined circuit,

(iv) total current,

(v) total power factor. (13)

14. (a) A series L–R–C circuit has a sinusoidal input voltage of maximum value 12 V. If inductance, L = 20 mH, resistance, R = 80 Ω, and capacitance, C = 400 nF, determine

(i) the resonant frequency,

(ii) the value of the potential difference across the capacitor at the resonant frequency,

(iii) the frequency at which the potential difference across the capacitor is a maximum, and

(iv) the value of the maximum voltage across the capacitor. (13)

Or

(b) A coil of inductance 5 mH and resistance 10 Ω is connected in parallel with a 250 nF capacitor across a 50 V variable-frequency supply. Determine

(i) the resonant frequency,

(ii) the dynamic resistance,

(iii) the current at resonance, and

(iv) the circuit Q-factor at resonance. (13)

15. (a) (i) Derive the formula for mutual inductance in terms of coefficient of coupling and self-inductance. (10)

(ii) What is the maximum possible mutual inductance of two inductively coupled coils with self-inductances L_1 = 25mH and L_2 = 100mH? (3)

Or

(b) Write short notes for the following :

(i) The Linear Transformer (8)

(ii) Network Topology. (5)

PART C — (1 × 15 = 15 marks)

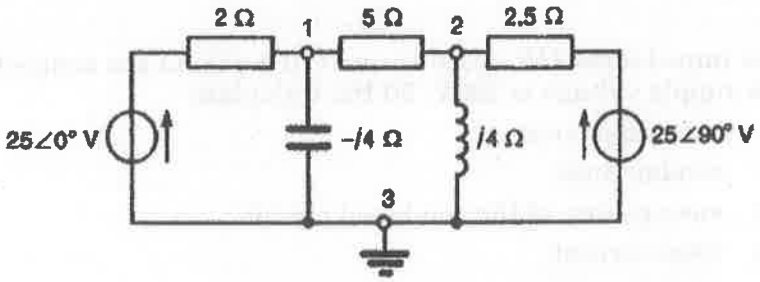
16. (a) In the network of figure shown here, use nodal analysis to determine

(i) the voltage at nodes 1 and 2.

(ii) the current in the j4 Ω inductance,

(iii) the current in the 5 Ω resistance, and

(iv) the magnitude of the active power dissipated in the 2.5 Ω resistance. (15)



Or

(b) For the a.c. network shown in Figure determine, using mesh-current analysis,

(i) the mesh currents I1 and I2

(ii) the current flowing in the capacitor, and

(iii) the active power delivered by the 100∠0° V voltage source. (15)