

B.Tech/M.Tech(Integrated) DEGREE EXAMINATION, DECEMBER 2023

Second Semester

21EEC101J - ELECTRIC CIRCUITS

(For the candidates admitted during the academic year 2022-2023 onwards)

Note:

- i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours**Max. Marks: 75**

PART - A (20 × 1 = 20 Marks)

Answer all Questions

PART - A (20 × 1 = 20 Marks)		Marks	BL	CO
Answer all Questions				
1.	The currents of 10 A and 5 A are entering a node in a junction of a circuit, whereas 3A and I A of currents are leaving the node. The I A of current is _____. (A) 18 A (B) -18 A (C) 12 A (D) -12 A	1	2	1
2.	The nodal method of circuit analysis is based on (A) KVL and Ohm's law (B) KCL and Ohm's law (C) KVL and KCL (D) KVL, KCL and Ohm's law	1	1	1
3.	A practical voltage source consists of (A) an ideal voltage source in series with an internal resistance (B) an ideal voltage source in parallel with an internal resistance (C) an ideal current source in series with an internal resistance (D) an ideal current source in parallel with an internal resistance	1	1	1
4.	The power dissipation in each of three parallel branches is 1 W. What is the total power dissipation of the circuit? (A) 0.33 W (B) 4 W (C) 3 W (D) 5 W	1	1	1
5.	In a two terminal passive element the voltage across it and the current through it are $v(t) = 0.8 \cos(\omega t - 600)$ V and $i(t) = 4 \cos(\omega t + 300)$ A. The element is (A) a capacitor with reactance 0.2 Ω (B) an inductor with reactance 0.2 Ω (C) a capacitor with reactance 5 Ω (D) an inductor with reactance 5 Ω	1	2	2
6.	With $\omega = 100$ rad./sec., the impedance of the 10 μ F capacitor is (A) j 0.001 Ω (B) - j 0.001 Ω (C) j 1000 Ω (D) - j 1000 Ω	1	3	2
7.	A series RLC circuit has $R = 10 \Omega$, $X_L = 20 \Omega$ and $X_C = 30 \Omega$. The impedance of the circuit is (A) $(10 + j 50) \Omega$ (B) $(10 - j 10) \Omega$ (C) $(10 + j 10) \Omega$ (D) $(10 - j 50) \Omega$	1	3	2
8.	In a RLC series circuit connected to variable frequency supply, when the frequency is less than the resonance frequency (A) $X_C > X_L$ and the power factor is lagging (B) $X_C > X_L$ and the power factor is leading (C) $X_L > X_C$ and the power factor is lagging (D) $X_L > X_C$ and the power factor is leading	1	2	2

9. Thevenin's equivalent circuit consists of (A) voltage source in series with an impedance. (C) current source in series with an impedance.	(B) voltage source in parallel with an impedance. (D) current source in parallel with an impedance	1	1	3
10. Superposition theorem is valid only for (A) non-linear circuits (C) linear circuits	(B) both linear and non-linear circuits (D) coplanar circuits	1	1	3
11. The dual pair of capacitance is _____ (A) capacitance (C) resistance	(B) inductance (D) current source	1	1	3
12. Which one of the following theorems is a manifestation of the law of Conservation of energy? (A) Compensation theorem (C) Thevenin's theorem	(B) millman's theorem (D) Tellegan's theorem	1	1	3
13. Time constant of an RC circuit with $R = 20 \Omega$ and $C = 250 \mu F$ is (A) $12.5 \mu s$ (C) $0.08 s$	(B) $0.125 s$ (D) $5ms$	1	3	4
14. In an RL circuit with time constant $2 s$, inductor current increases from the initial value of zero to the final value of $1.5 A$. Inductor current is given by (A) $i_L(t) = 1.5 (1 - e^{-2t}) A$ (C) $i_L(t) = 1.5 e^{-2t} A$	(B) $i_L(t) = 1.5 (1 - e^{-0.5t}) A$ (D) $i_L(t) = 1.5 e^{-0.5t} A$	1	3	4
15. A capacitor of $0.2 F$ has zero initial charge. Its transform impedance is (A) $0.2 / s$ (C) $5s$	(B) $0.2 s$ (D) $5 / s$	1	2	4
16. Transient behavior occurs in any circuit when (A) the applied voltage is constant (C) circuit is connected or disconnected from the load	(B) the source voltage is open (D) the output voltage is varying	1	1	4
17. Real power consumed by a balanced three-phase load can be computed as (A) $P = \sqrt{3} E_f I_f \cos \theta$ (C) $P = \sqrt{3} E_{ph} I_{ph} \cos \theta$	(B) $P = E_f I_f \cos \theta$ (D) $P = 3 E_f I_f \cos \theta$	1	1	5
18. With three-phase balanced supply voltage having a phase sequence of ABC (A) Voltage V_{AB} leads voltage V_A by 60° (C) Voltage V_{AB} lags voltage V_A by 30°	(B) Voltage V_{AB} lags voltage V_A by 60° (D) Voltage V_{AB} leads voltage V_A by 30°	1	2	5
19. The inverse hybrid parameter g_{11} is (A) impedance (C) voltage ratio	(B) admittance (D) current ratio	1	1	5
20. The transmission parameter B is (A) impedance (C) voltage ratio	(B) admittance (D) current ratio	1	1	5

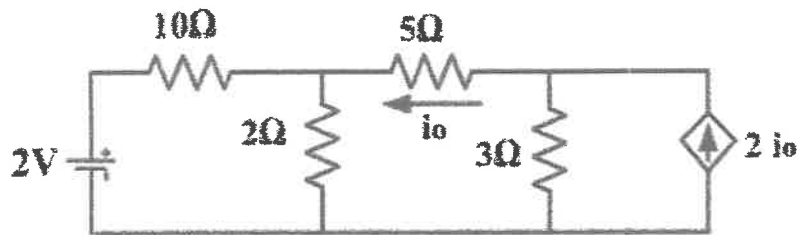
PART - B ($5 \times 8 = 40$ Marks)

Answer all Questions

Marks BL CO

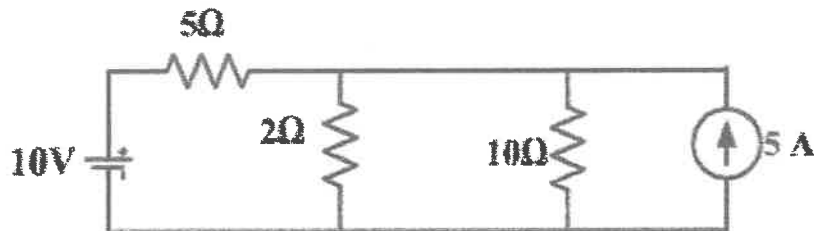
21. (a) Using mesh analysis, find the current supplied by the voltage source from the given circuit.

8 3 1



(OR)

- (b) Using the nodal analysis, find the current in 10 Ω resistor.



22. (a) The circuit voltage and the circuit current in a passive linear circuit are $v(t) = 75 \cos(10t + 20^\circ)$ V and $i(t) = 20 \sin(10t + 60^\circ)$. Find the instantaneous power and the average power.

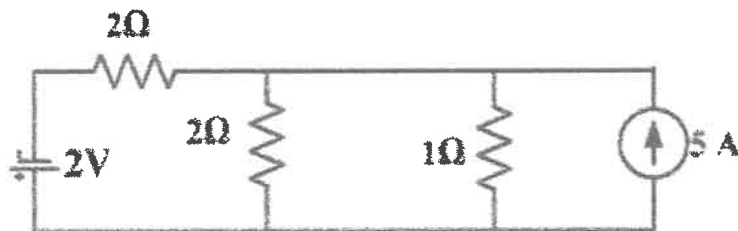
8 3 2

(OR)

- (b) For an RLC series circuit supplied with 220V, 50 Hz ac supply, $R = 40 \Omega$, $L = 0.2$ H, $C = 20 \mu\text{F}$, calculate the impedance of the circuit, the power factor of the circuit, and the voltages across each of the three elements in the circuit.

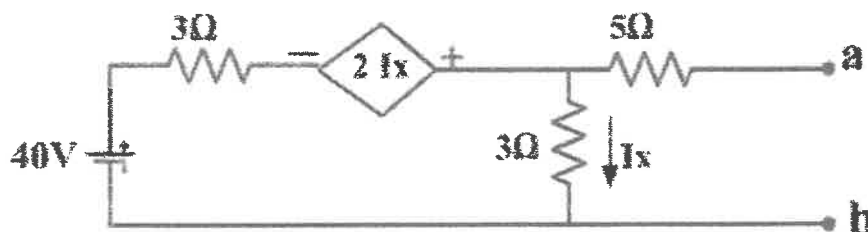
23. (a) Calculate the current through the 1 Ω resistor in the given circuit .

8 3 3



(OR)

- (b) Determine the Thevenin's equivalent circuit across a-b in the given circuit.



24. (a) A capacitor in an RC circuit with $R = 30 \Omega$ and $C = 60 \mu\text{F}$ is being charged with initial zero voltage. What is the time taken for the capacitor voltage to reach 20 % of its steady state value?

8 4 4

(OR)

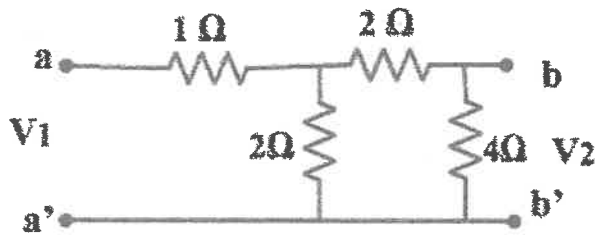
- (b) In a RL circuit with time constant of 2 s, inductor current increases from the initial value of zero to the final value of 2 A.
 (i) Calculate the inductor current at time 0.3 s, 0.5 s and 2 s.
 (ii) Find the time at which the inductor current reaches 0.2 A, 0.4 A and 0.8 A.

25. (a) Explain the measurement of three phase real power in a star connected load using two wattmeter method. Derive and obtain the equation for total power consumed by the load.

8 4 5

(OR)

- (b) Determine the h parameters for the circuit shown below.



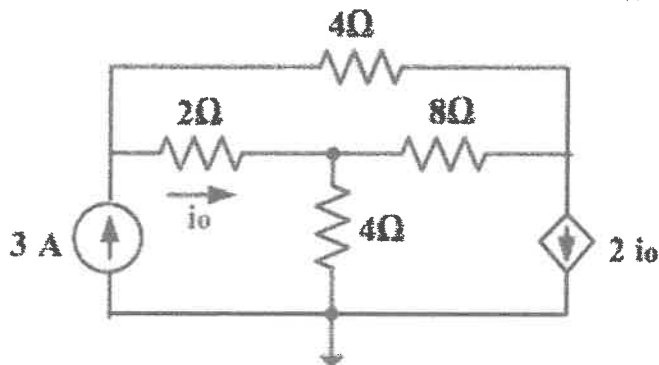
PART - C (1 × 15 = 15 Marks)

Answer **any 1** Questions

Marks BL CO

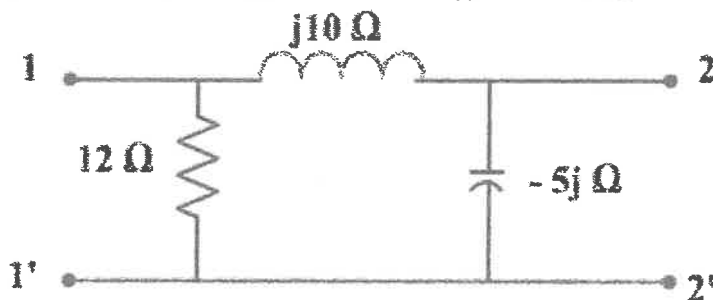
26. Determine the voltages at the nodes in the circuit given below.

15 4 1



27. Determine the Y parameters for the given circuit .

15 4 5



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