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

Second Semester

Electrical and Electronics Engineering

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

24EEPC201 - CIRCUIT THEORY

Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

	Marks	K-Level	CO

1. A 10V voltage source with a 5Ω resistor in series can be transformed into a current source of: *1 K2 CO1*
   (a) 10A   (b) 2A   (c) 0.5A   (d) 5A

2. Voltage division rule applies to: *1 K1 CO1*
   (a) Series circuits   (b) Parallel circuits
   (c) Both series and parallel circuits   (d) None

3. If the peak voltage of an AC signal is 100V, its RMS value is approximately: *1 K2 CO2*
   (a) 50V   (b) 70.7V   (c) 100V   (d) 141.4V

4. Which method is easier when there are multiple current sources?   *1 K1 CO2*
   (a) Mesh Current Method   (b) Node Voltage Method
   (c) Superposition Theorem   (d) Thevenin's Theorem

5. The Maximum Power Transfer Theorem applies to: *1 K1 CO3*
   (a) Only resistive circuits   (b) AC circuits
   (c) Both AC and DC circuits   (d) Only reactive circuits

6. Which of the following is true for the Superposition Theorem?   *1 K1 CO3*
   (a) It can be applied only to circuits with only resistors
   (b) The individual voltages from each source are summed algebraically
   (c) It gives the same result as a direct solution using Kirchhoff's Laws
   (d) It cannot be used with current sources

7. For an RL circuit with DC excitation, the voltage across the inductor at steady-state is: *1 K1 CO4*
   (a) Zero
   (b) Equal to the source voltage
   (c) The sum of the resistive voltage drop and the inductive voltage drop
   (d) Infinite

8. In the transient analysis of a series RLC circuit, the response of the circuit can be found by: *1 K1 CO4*
   (a) Solving the characteristic equation of the system
   (b) Using Kirchhoff's laws only
   (c) Using Ohm's Law
   (d) Directly applying the inverse Laplace transform

9. In a series resonant circuit, the impedance at resonance is: *1 K1 CO5*
   (a) Minimum   (b) Maximum   (c) Zero   (d) Infinite

10. In a 3-phase 4-wire system, the fourth wire is called the: *1 K1 CO6*
    (a) Ground   (b) Neutral   (c) Return   (d) Earth

*K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create*

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. State Ohm's law. Mention the limitations of ohm's law?   *2 K1 CO1*

12. Two resistors 4Ω and 6Ω are connected in parallel. The total current flowing through the resistors is 5A. Find the current flowing through each resistor.   *2 K2 CO1*

13. Define real power, reactive power, and apparent power in AC circuits.   *2 K1 CO2*

14. What is the average value of a sinusoidal waveform over one full cycle?   *2 K1 CO2*

15. List out the applications of maximum power transfer theorem.   *2 K1 CO3*

16. A load is connected to a network of the terminals to which load is connected with $R_{th}=10\Omega$ and $V_{th}=40V$. Calculate the maximum power supplied to the load.   *2 K2 CO3*

17. Define the term 'time constant'.   *2 K1 CO4*

18. Define the term forced response of a circuit.   *2 K1 CO4*

19. Find the maximum possible mutual inductance of two Inductively coupled circuits with self inductance $L_1 =16$ H and $L_2=4H$.   *2 K2 CO5*

20. Define bandwidth of the resonant circuit.   *2 K1 CO5*

21. Compare between balanced supply and unbalanced load.   *2 K2 CO6*

22. List out the advantages of 3-phase system over 1 phase system.   *2 K1 CO6*

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23. a) Solve the Loop currents I_1, I_2 and I_3 by using Mesh loop analysis as shown in Fig.   *11 K3 CO1*
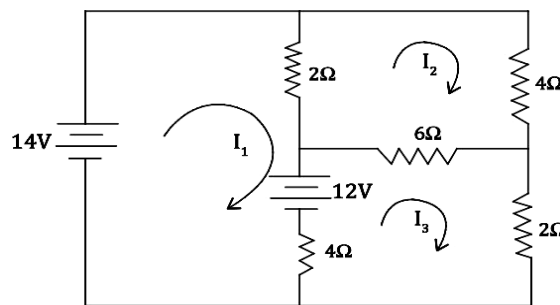
OR

b) Make use of Nodal Voltages analysis method, derive and formulate the value of $V1$, and $V2$ as shown in Fig.   *11 K3 CO1*
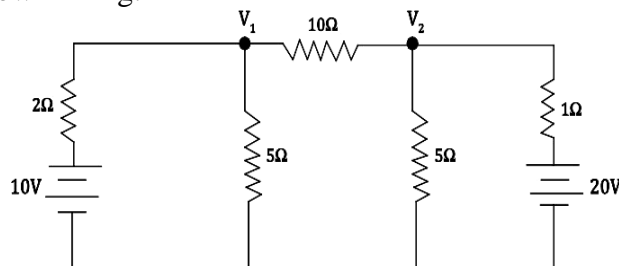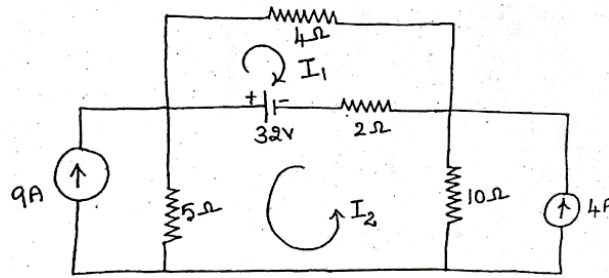

24. a) Solve the currents in various branches of the circuit shown in Figure using mesh analysis.   *11 K3 CO2*
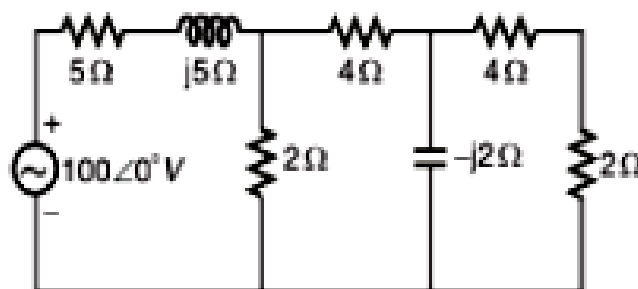
OR

b) Develop the expressions for RMS value, average value, Form Factor and Peak Factor of a sinusoidal voltage.   *11*   *K3*   *CO2*

25. a) Solve the current through 5 Ω resistor using superposition theorem, in the circuit shown in Fig.   *11*   *K3*   *CO3*
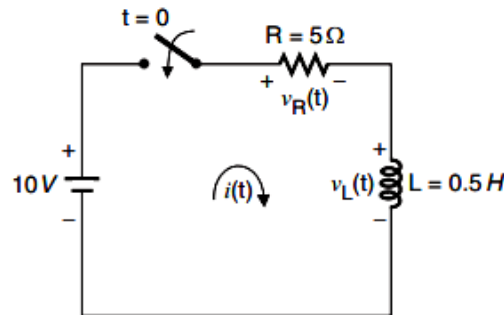

OR

b) Make use of Thevenin's theorem, Evaluate the current through R_L=10 Ohm as shown in Fig. and find power developed by Load.   *11*   *K3*   *CO3*
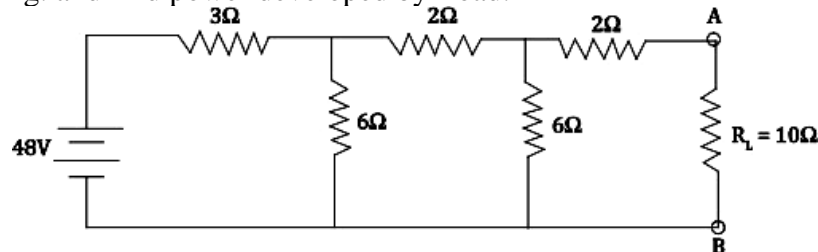
26. a) In the RL circuit of Fig. 1, the switch is closed at t = 0. Solve the current i(t) and the voltage across resistance and inductance.   *11*   *K3*   *CO4*

OR

b) Develop the transient response of series R-L circuit, with AC input, using Laplace transform and also sketch the transient response curve.   *11*   *K3*   *CO4*

27. a) A series circuit with R=10Ω, L=0.1H and C=50μF has an applied voltage $V=50\angle 0^O$ V with a variable frequency. Find (1) the resonant frequency (2) the value of frequency at which maximum voltage occurs across inductor (3) value of frequency at which maximum voltage occurs across capacitor (4) quality factor of coil.   *11*   *K3*   *CO5*

OR

b) Develop the mutual inductance and the coupling coefficient of the transformer with necessary illustration.   *11*   *K3*   *CO5*

28. a) A balanced Star connected load of (4+j3) Ohm / Phase is connected to a 3-Phase, 230V, 50Hz Supply. Evaluate (i) Line Current (ii) Power Factor (iii) Reactive volt Amperes (iv) Power in VA.   *11*   *K3*   *CO6*

OR

b) Construct the power and power factor measuring in the three phase by two wattmeter method.   *11*   *K3*   *CO6*

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