B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
Second Semester

Electrical and Electronics Engineering

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

24EEPC201 - CIRCUIT THEROY

Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

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

		Marks	K-Level	CO

1. Show how to combine four 100 Ω resistors to obtain an equivalent resistance of — 1, K1, CO1
   (a) 25 Ω   (b) 60 Ω   (c) 40 Ω   (d) 50 Ω
2. If one of the resistors in a parallel circuit is removed, what happens to the total resistance? — 1, K1, CO1
   (a) decreases   (b) increases   (c) remain constant   (d) exactly doubles
3. If a sinusoidal wave has frequency of 50 Hz with 15 A rms value which of the following equation represents this wave — 1, K1, CO2
   (a) 15sin50t   (b) 30sin 25t   (c) 42.42 sin100t   (d) 21.21sin314t
4. Infer the power factor of 0 indicates — 1, K2, CO2
   (a) purely resistive element   (b) purely reactive element
   (c) combination of both (a) and (b)   (d) none of the above
5. Which of the following theorems is applicable for both linear and non-linear circuits? — 1, K1, CO3
   (a) Superposition   (b) Thevenin   (c) Norton   (d) None of these
6. Select, if all the elements in a particular network are linear then the superposition theorem holds when the excitation is — 1, K1, CO3
   (a) dc only   (b) ac only   (c) either ac or dc   (d) an impulse
7. Transient behaviour occurs in any circuit when — 1, K1, CO4
   (a) there are sudden changes of applied voltage   (b) the voltage source is shorted.
   (c) the circuit is connected or disconnected from the supply   (d) all of the above happen.
8. Interpret the transient current in a loss-free LC circuit when excited from an ac source is a sine wave — 1, K2, CO4
   (a) undamped   (b) over damped   (c) under damped   (d) critically damped.
9. Find the resonance frequency of a RLC series circuit consists of R = 16 Ω, L = 13 µH and C = 41 µF. — 1, K1, CO5
   (a) 207 Hz   (b) 218 Hz   (c) 436 Hz   d) 1370 Hz
10. In two-wattmeter method, the readings of wattmeter for a balanced load are, W_1 = 500 W, W_2 = 400 W. What is the power factor of the load? — 1, K1, CO6
    (a) 0.347   (b) 0.949   (c) 0.999   (d) 0.982
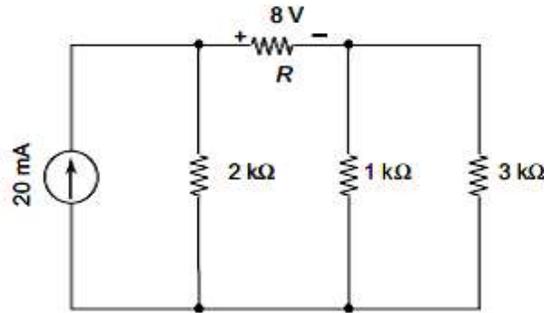
PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. Solve the resistance across A-B in the circuit shown in Fig. — 2, K2, CO1
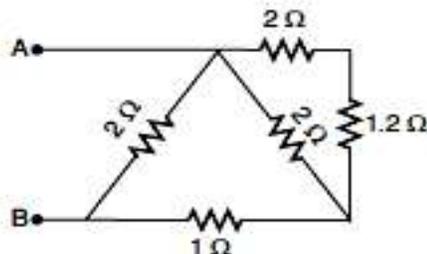
12. Identify the power dissipated in resistor R for the circuit shown below.   *2   K2   CO1*

13. A sinusoidal current is given by the equation i(t) = 7.072 sin 314t A. What is the rms and   *2   K1   CO2*
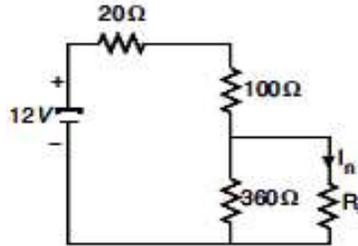   average value of the current?
14. How is nodal analysis performed?   *2   K1   CO2*
15. Find the value of I_n for the circuit shown in Fig   *2   K1   CO3*

16. Recall the limitations of the superposition theorem.   *2   K1   CO3*
17. Illustrate the source free and forced response.   *2   K2   CO4*
18. Solve current in the circuit at t = 2 τ, a RL series circuit with R = 10 Ω is excited by a dc   *2   K2   CO4*
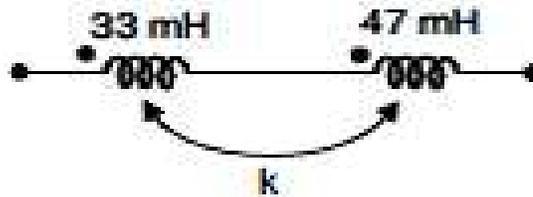   voltage source of 30 V by closing the switch at t = 0.
19. Identify the value of capacitance and maximum current flows in a coil resistance of 2.2 Ω   *2   K2   CO5*
    and an inductance of 0.01 H is connected in series with a capacitor across 220 V, 190 Hz.
20. Find the equivalent inductance of the circuit shown in Fig. if the coefficient of coupling   *2   K2   CO5*
    (k) between the two coils is 0.6.

21. Compare between unbalanced source and unbalanced load.   *2   K2   CO6*
22. Find the power and power factor a balanced delta-connected load of 4 – j6 Ω impedance is   *2   K2   CO6*
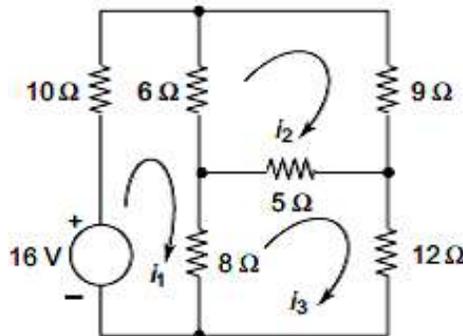   connected to 400V, 3-phase supply.

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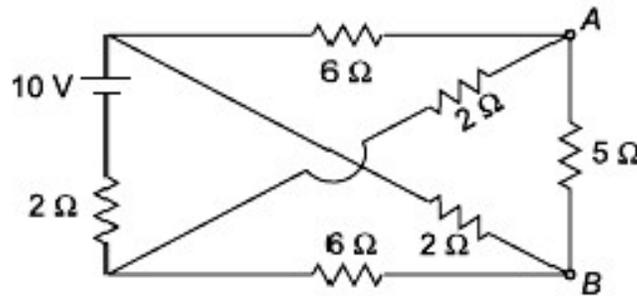Answer ALL Questions

23.   a)   Apply the circuit by the mesh method. From the results, solve the current in the 5Ω   *11   K3   CO1*
   resistance.

OR

b) Identify the voltage across AB in the network shown in Fig. and indicate the   *11   K3   CO1*
polarity of the voltage using star-delta transformation.


24. a) i. Develop the expression below using the phasor method   *4   K3   CO2*
   $e(t) = 100\sqrt{2} \cos(314t - 30°) + 200\sqrt{2} \sin(314t - 60°)$
   ii. Solve the true power, reactive power and power factor of the circuit. A sine wave of   *7   K3   CO2*
   $v(t) = 200 \sin 50t$ is applied to a 10 Ω resistor in series with a coil. The reading of a
   voltmeter across the resistor is 120 V and across the coil, 75 V.

OR

b) Solve the voltages across various elements in the circuit shown in Fig. by utilize   *11   K3   CO2*
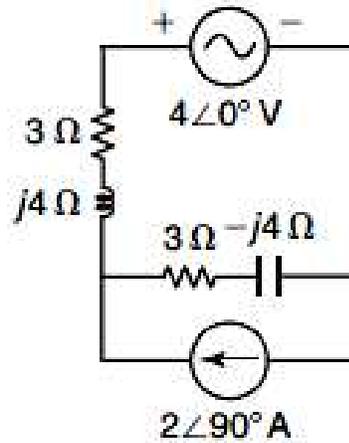node method.
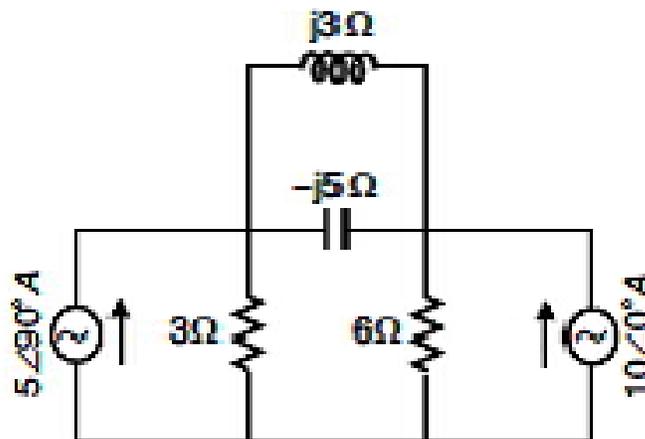
25. a) Identify the current through the galvanometer shown in Fig., using Thevenin's   *11   K3   CO3*
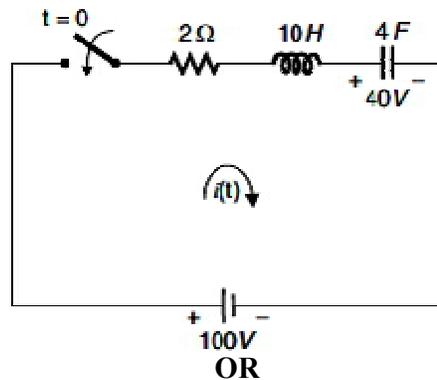theorem.
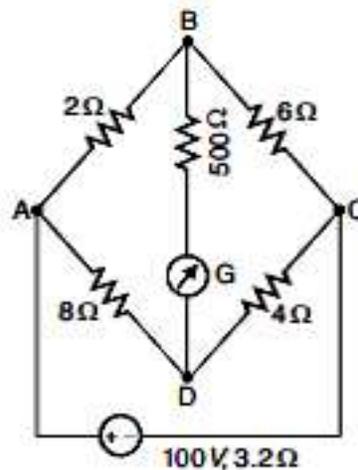
OR

b)   Make use of Superposition theorem to solve the current in the capacitor branch.   *11*   *K3*   *CO3*

26.   a)   Identify the current i(t) in the RLC circuit, capacitor has an initial voltage of 40 V,   *11*   *K3*   *CO4*
          when the switch is closed at t = 0.

OR

b)   Construct the values of i, di /dt and d^2i/dt^2 at t = 0^+ in the network shown in Fig.   *11*   *K3*   *CO4*
     the switch is changed from the position 1 to the position 2 at t = 0, steady condition
     having reached before switching.
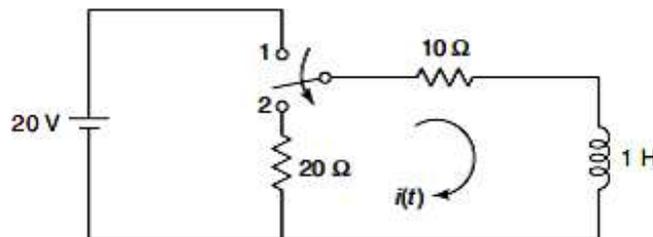
27.   a)   Develop the expression of resonant frequency, Q-factor, bandwidth and maximum   *11*   *K3*   *CO5*
          current of RLC series resonance circuit.

OR

b)   Select the self-inductance and mutual inductance of the two coils, connected in   *11*   *K3*   *CO5*
     series have an equivalent inductance of 0.8 H, when connected in aiding and an
     equivalent inductance of 0.4 H, when connected in opposing. Take k = 0.55.

28.   a)   Develop the expression of line and phase voltages, currents, power, and power   *11*   *K3*   *CO6*
          factor of three phase star connected balanced load.

OR

b)   Select the reading on each of the two- wattmeter connected to measure the input of   *11*   *K3*   *CO6*
     a 500 V, 3-phase motor has an output of 3.73 kW and operates at a power factor of
     0.85, with an efficiency of 90%.