

Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech(EIE)/SEM-3/EE-301(EI)/2009-10

2009

CIRCUIT THEORY & NETWORKS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

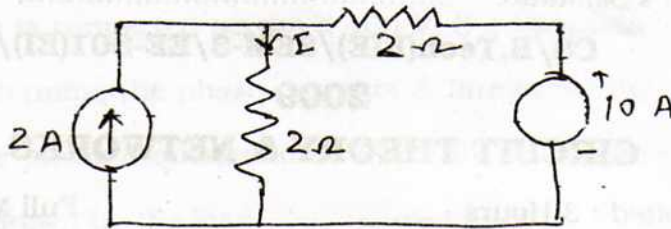
- i) If the voltage across a given capacitor is increased, the amount of stored charge
 - a) increases
 - b) decreases
 - c) remains constant
 - d) is exactly doubled.
- ii) A practical voltage source consists of
 - a) an ideal voltage source in series with an internal resistance
 - b) an ideal voltage source in parallel with an internal resistance
 - c) both (a) & (b) are correct
 - d) none of these.

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iii) Determine the current I in the circuit shown in figure :



- a) 2.5 A b) 1A
c) 3.5 A d) 4.5 A.

iv) A 1 kHz sinusoidal voltage is applied to an RL circuit. What is the frequency of the resulting current ?

- a) 1 kHz b) 0.1 kHz
c) 100 kHz d) 2 kHz.

v) A series circuit consisting of two elements has the following current & applied voltage :

$$i = 4 \cos (2000 t + 11.32^\circ) \text{ A}$$

$$v = 200 \sin (2000 t + 50^\circ) \text{ V}$$

The circuit elements are

- a) resistance & capacitance
b) capacitance & inductance
c) inductance & resistance
d) both resistances.

vi) In a certain RL circuit, $V_R = 2 \text{ V}$ & $V_L = 3 \text{ V}$.

What is the magnitude of the total voltage ?

- a) 2 V b) 3 V
c) 5 V d) 3.61 V.

vii) Maximum power transfer occurs at

- a) 100% efficiency b) 50% efficiency
c) 25% efficiency d) 75% efficiency.

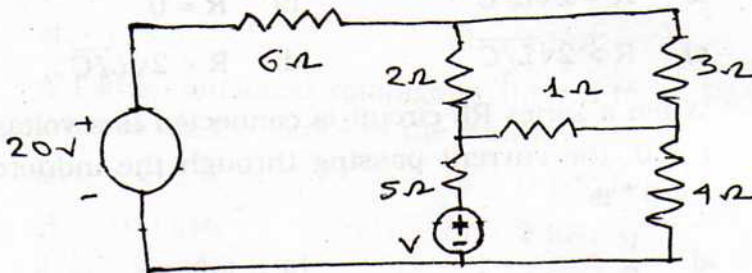
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- viii) A source has an emf of 10V and impedance of $500 + j100\Omega$. The amount of maximum power transferred to the load will be
- a) 0.5 mW b) 0.05 mW
 c) 0.05 W d) 0.5 W.
- ix) Transient current in an RLC circuit is oscillatory when
- a) $R = 2\sqrt{L/C}$ b) $R = 0$
 c) $R > 2\sqrt{L/C}$ d) $R < 2\sqrt{L/C}$.
- x) When a series RL circuit is connected to a voltage V at $t = 0$, the current passing through the inductor L at $t = 0^+$ is
- a) $\frac{V}{R}$ b) infinite
 c) zero d) $\frac{V}{L}$.
- xi) The current in the neutral wire of a balanced three-phase, four-wire star-connected load is given by
- a) zero
 b) $\sqrt{3}$ times the current in each phase
 c) 3 times the current in each phase
 d) the current in each phase.
- xii) A two port network is simply a network inside a black box & the network has only
- a) two terminals
 b) two pairs of accessible terminals
 c) two pairs of ports
 d) 4 pairs of ports.

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GROUP - B**(Short Answer Type Questions)**Answer any three of the following. $3 \times 5 = 15$

2. Determine the voltage V which causes the current I_1 to be zero in the circuit shown Use mesh analysis.



3. A series circuit consisting of two pure elements has the following current & voltage :

$$v = 100 \sin (2000 t + 50^\circ) V$$

$$i = 20 \cos (2000 t + 20^\circ) A$$

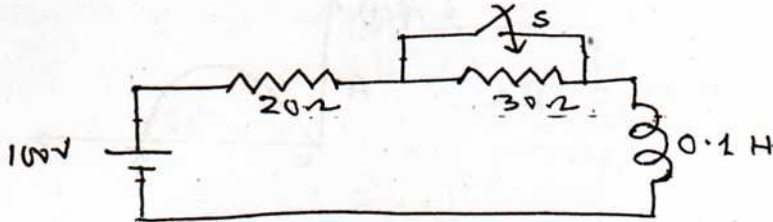
Find the element in the circuit.

4. A three phase balanced delta-connected load with line voltage of 200 V, has line currents as $I_1 = 10 \angle 90^\circ$, $I_2 = 10 \angle -150^\circ$ & $I_3 = 10 \angle -30^\circ$.

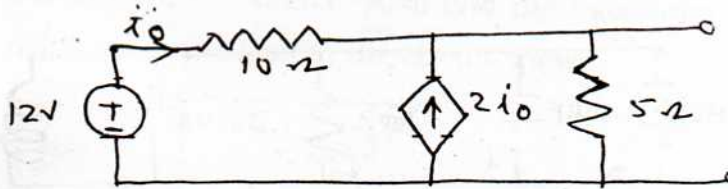
- What is the phase sequence ?
- What are the impedances ?

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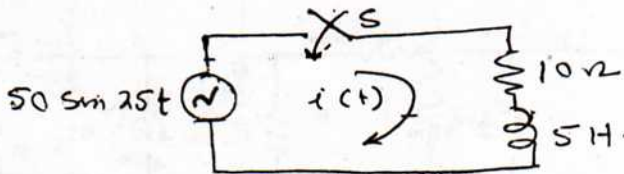
5. For the circuit shown in figure, find the complete expression for the current when the switch is closed at $t = 0$:



6. Find the Norton's equivalent circuit across terminal AB for the circuit shown.

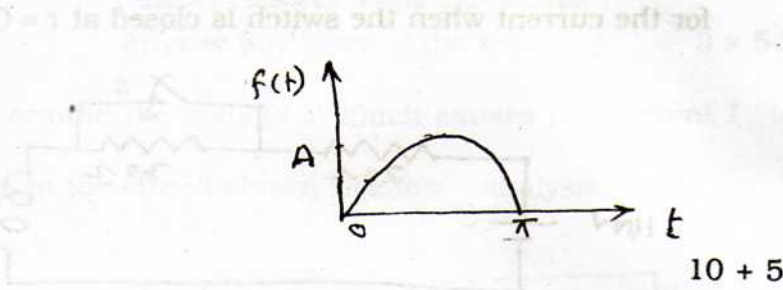
**GROUP - C****(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. a) The circuit shown in figure consists of series $R - L$ elements. The sine wave is applied to the circuit when the switch S is closed at $t = 0$. Determine the current $i(t)$

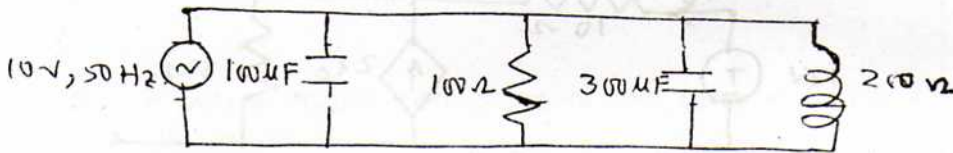


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b) Find the Laplace transform of the waveform shown :

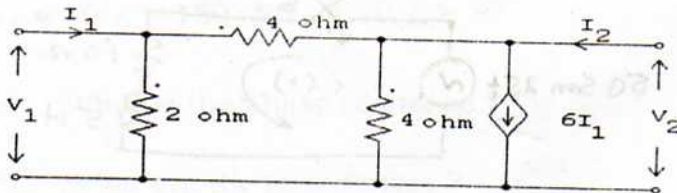


8. a) For the parallel circuit shown in figure. Find the magnitude of current in each branch & the total current. What is the phase angle between the applied voltage & current ?



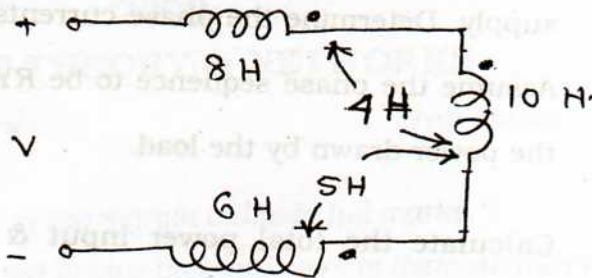
b) Two impedances $Z_1 = 20 + j 10$ & $Z_2 = 10 - j 30$ are connected in parallel & this combination is connected in series with $Z_3 = 30 + j X$. Find the value of X which will produce resonance. 9 + 6

9. a) Find Z-parameters of the network shown in figure. Hence find the ABCD parameters for the same network.



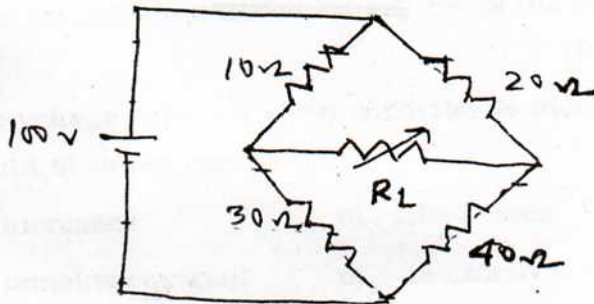
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- b) Calculate the effective inductance of the circuit shown in figure

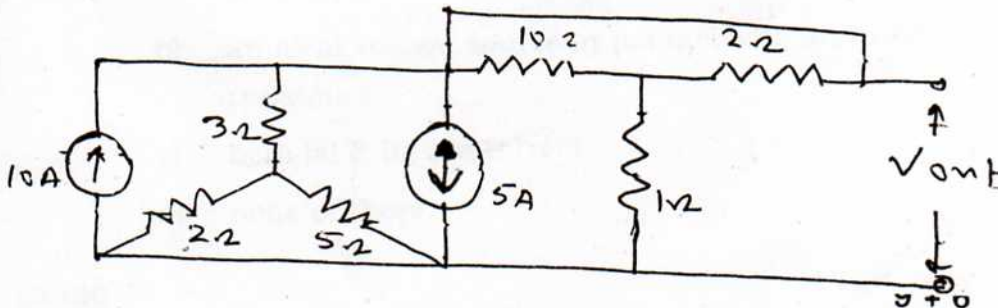


10 + 5

10. a) Determine the load resistance to receive maximum power from the source. Also find the maximum power delivered to the load in the circuit shown.



- b) Determine the output voltage V_{out} in the circuit shown.



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11. a) A three phase, balanced delta connected load of $(4 + j8) \Omega$ is connected across a 400 V, 3 ϕ balanced supply. Determine the phase currents & line currents. Assume the phase sequence to be RYB. Also calculate the power drawn by the load.
- b) Calculate the total power input & readings of the two wattmeters connected to measure power in a three phase balanced load if the reactive power input is 15 kVAR & load p.f. is 0.8. 10 + 5
