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 :

$$10 \times 1 = 10$$

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 is figure :
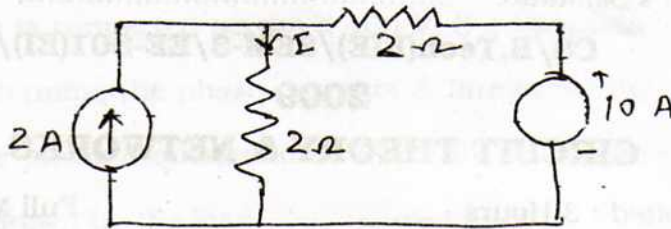
  a)   2·5 A   b)   1A

  c)   3·5 A   d)   4·5 A.

iv) A 1 kHz sinusoidal volatage 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 :

$$i = 4 \cos (2000 \, t + 11·32°) \, A$$

$$v = 200 \sin (2000 \, t + 50°) \, V$$

The circuit elements are

  a)   resistance & capacitance

  b)   capacitance & inductance

  c)   inductance & resistance

  d)   both resistances.

vi) In a certain RL circuit, $V_R = 2$ V & $V_L = 3$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
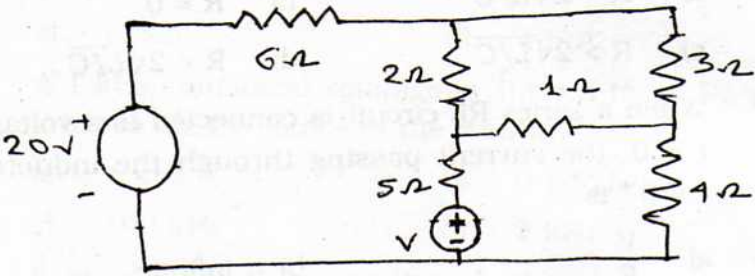
  c)   25% efficiency   d)   75% efficiency.

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) $\dfrac{V}{R}$ b) infinite

c) zero   d) $\dfrac{V}{L}$.

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.

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 cricuit consisting of two pure elements has the following current & voltage :
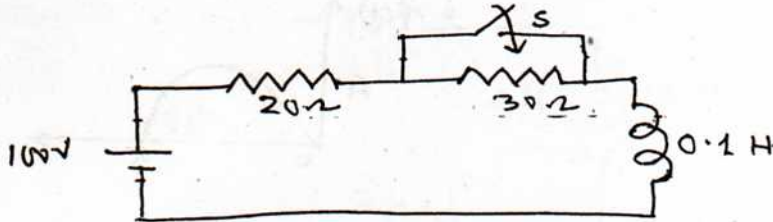
$$v = 100 \sin (2000\, t + 50°)\ V$$

$$i = 20 \cos (2000\, t + 20°)\ A$$

Find the element in the circuit.

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

    a) What is the phase sequence ?

    b) What are the impedances ?

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

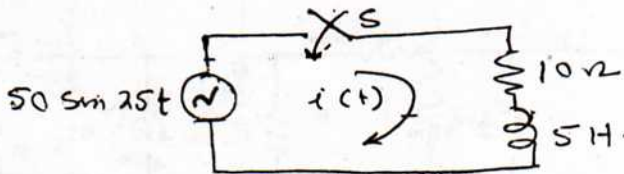6. Find the Norton's equivalent circuit across terminal AB for the circuit shown.
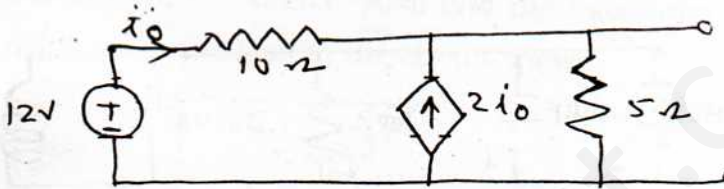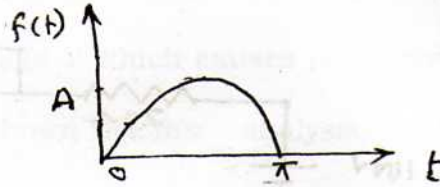

GROUP – C

(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 $i(t)$
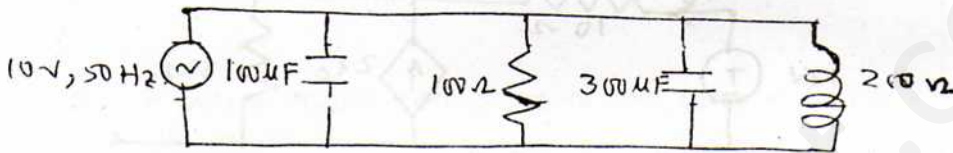
b) Find the Laplace transform of the waveform shown :

$10 + 5$

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 ?
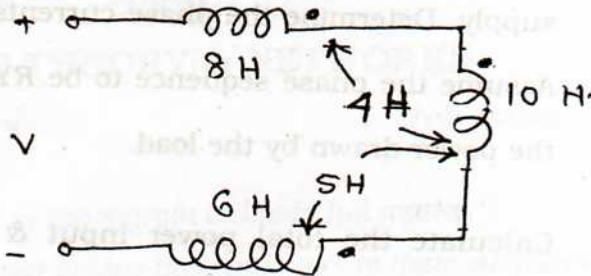

b) Two impedances $Z_1 = 20 + j\,10$ & $Z_2 = 10 - j\,30$ are connected in parallel & this combination is connected in series with $Z_3 = 30 + j\,X$. Find the value of X which will produce resonance. $9 + 6$

9. a) Find Z-parameters of the network shown in figure. Hence find the $ABCD$ parameters for the same network.
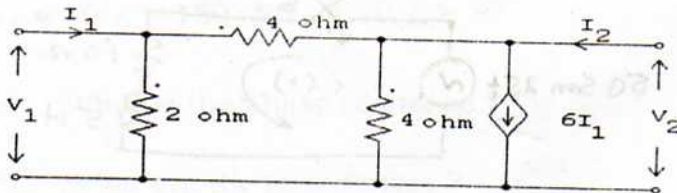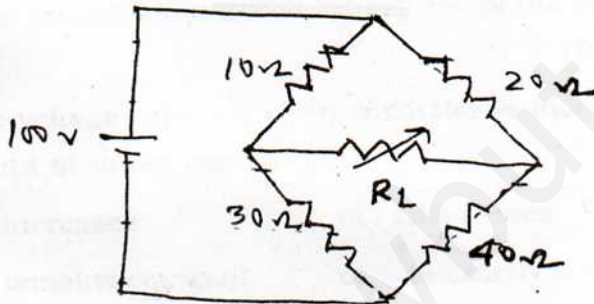
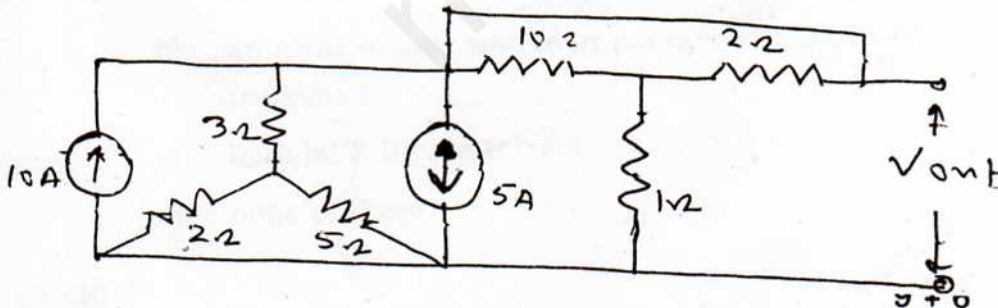b) Calculate the effective inductance of the circuit shown in figure

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