

Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (EIE)/SEM-3/EE-301(EI)/2010-11**2010-11****CIRCUIT THEORY & NETWORKS**

Time Allotted : 3 Hours

Full Marks : 70

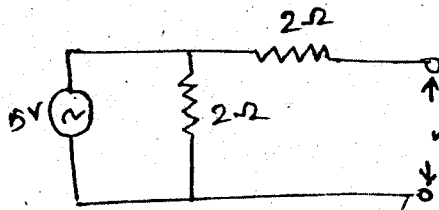
*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.***GROUP - A****(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any ten of the following : $10 \times 1 = 10$

i) Which of the following represents the Laplace transform of an impulse function of strength A ?

- | | |
|-------|-------------------|
| a) A | b) A/S |
| c) AS | d) none of these. |

ii) Thevenin's equivalent resistance of the given circuit is



- | | |
|--------|--------|
| a) 2 Ω | b) 0 Ω |
| c) 1 Ω | d) 3 Ω |

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- iii) A series resonant circuit at resonance is called
- an acceptor circuit
 - a rejecter circuit
 - an oscillator circuit
 - none of these.
- iv) An impedance ($3 + j5$) ohm is connected in series with a 10 V, 50 Hz source. What is the real power drawn by the impedance ?
- 8.83 W
 - 14.7 W
 - 17.15 W
 - 13.27 W.
- v) When a series R-C circuit is connected to a constant voltage at $t = 0$, the current passing through the circuit at $t = 0+$ is
- infinite
 - zero
 - V/R
 - $V/\omega C$.
- vi) When two coils having self-inductance of L_1 & L_2 are coupled through a mutual inductance M , the coefficient of coupling, K is given by
- $K = \frac{M}{\sqrt{2 L_1 L_2}}$
 - $K = \frac{M}{\sqrt{L_1 L_2}}$
 - $K = \frac{.2M}{\sqrt{L_1 L_2}}$
 - $K = \frac{L_1 L_2}{M}$.

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- vii) Two wattmeter method of power measurement can be used to measure power in
- a) balanced circuit b) unbalanced circuit
 - c) both (a) & (b) d) none of these.
- viii) An RLC series circuit consists of a resistance 1 k. ohm, an inductance of 0.1 H and a capacitance of 10. The Q factor of the circuit will be
- a) 100 b) 50
 - c) 10 d) 1/100.
- ix) A resistor carries simultaneously a DC of 10 A and a sinusoidal AC peak value of 10 A. The rms value of the current will be
- a) 20 A b) 17.08 A
 - c) 14.14 A d) 12.24 A
- x) Two equal impedances $10 \angle 60^\circ$ are connected in parallel. Their equivalent impedance will be
- a) $20 \angle 60^\circ$ b) $10 \angle 120^\circ$
 - c) $15 \angle 120^\circ$ d) $5 \angle 60^\circ$.
- xi) Norton's equivalent circuit consists of
- a) voltage source in parallel with impedance
 - b) voltage source in series with impedance
 - c) current source in series with impedance
 - d) current source in parallel with impedance.

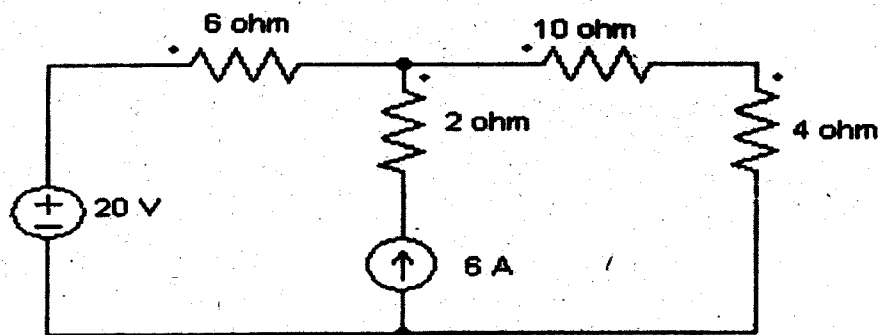
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xii) The principles of homogeneity and superposition are applied to

- a) linear time variant systems
- b) non-linear time variant systems
- c) linear time invariant systems
- d) non-linear time invariant systems.

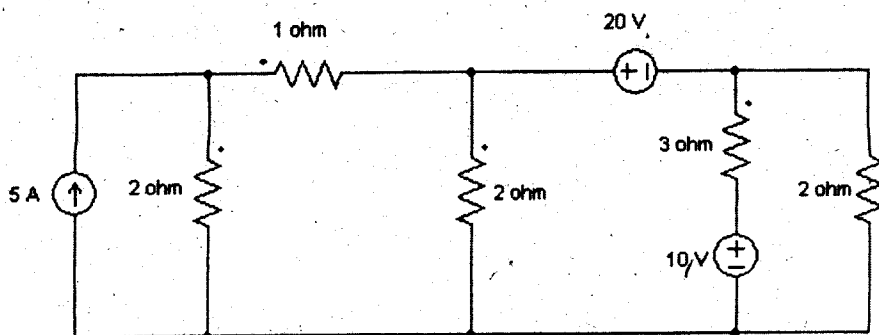
GROUP - B**(Short Answer Type Questions)**Answer any *three* of the following. $3 \times 5 = 15$

2. a) State & prove the maximum power transfer theorem. 3
- b) Show that the efficiency for maximum power transfer theorem is 50%. 2
3. Using Mesh analysis, find the current through 4Ω resistance for the circuit as shown in figure.



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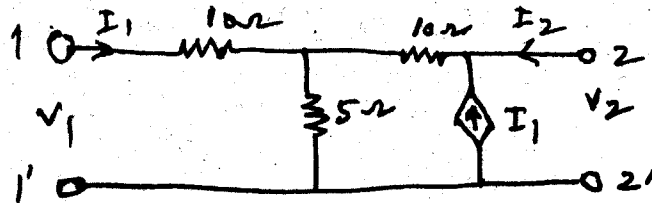
4. A voltage $v(t) = 100 \sin 10t$ is applied to series RLC circuit where, $R = 40 \text{ ohm}$, $L = 13\text{H}$, $C = 10\text{F}$. Find
- the power supplied by the source
 - the reactive power supplied by the source
 - the reactive power of the capacitor
 - the power factor of the circuit.
5. a) Two refrigerators are supplied from same a.c. mains. The first refrigerator draws a current of 2A at a power factor of 0.70 and the two together draw a current of 5A at a power factor of 0.64. Assuming that the current lags in both the cases, calculate the current drawn by the second refrigerator and power factor. 2
- b) Two series R-L-C circuits consist of L_1 , C_1 , R_1 and L_2 , C_2 , R_2 respectively having same resonate frequency. Show that if the two circuits are joined in series, the combined circuit will also resonate at the same frequency. 3
6. Calculate the current in 3Ω resistance by Nodal analysis for the circuit shown in figure.



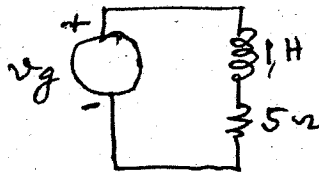
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GROUP - C**(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. a) What are Z parameters of a 2-port network ? Express them in terms of h-parameters.
- b) Determine the Z-parameters of the network shown and thus show that the circuit is neither reciprocal nor symmetrical.



8. a) A voltage of 125 V at 60 Hz is applied across a non-inductive resistor connected in series with a capacitor. The current is 2.2 A. The power loss in the resistor is 96.8 W and that in the capacitor is negligible. Calculate the resistance and capacitance. 5
- b) In the circuit shown by $V_g = 10 + 2 \sin 4t + \sin 10t$, determine the power consumed by and the p.f. of the circuit. 10



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9. a) Find the expression of mutual inductance in the series connection of two mutually coupled coils, when the two coils assist each other, the effective inductance is L_A and when the two coils oppose each other, the effective inductance is L_B . 8

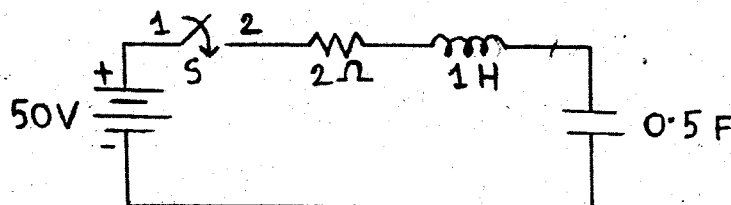
- b) Two coils $L_1 = 400 \mu H$ and $L_2 = 100 \mu H$ are magnetically coupled. The coefficient of coupling between two coils is 0.1. Calculate effective inductance if two coils are connected in

i) series adding

ii) series opposing. 7

10. a) Determine the Laplace transform of $F(t) = [2 - 2e^{-(t)}]/t$. 6

- b) In the series R-L-C circuit as shown, there is no initial charge on the capacitor. If the switch is closed at $t = 0$, determine the resulting current at $i(t)$. 9



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11. a) Two coils $L_1 = 2H$ and $L_2 = 4H$ are magnetically coupled. The coefficient of coupling between two coils is 0.3535. Calculate effective inductance if two coils when connected in

i) series adding

ii) series opposing.

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b) A balanced delta-connected load having an impedance $Z_L = (300 + j210)$ ohm in each phase is supplied from a 400 V, 3-phase supply through a 3-phase line having an impedance of $Z_s = (4 + j8)$ ohm in each phase. Find the total power supplied to the load as well as the current and voltage in each phase of the load.

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