



Time Allotted : 3 Hours

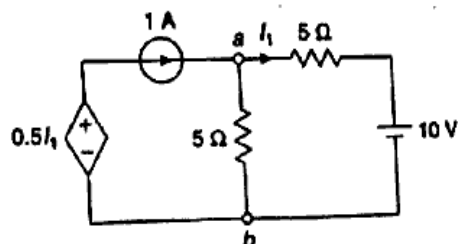
Full Marks : 70

*The Figures in the margin indicate full marks.  
 Candidate are required to give their answers in their own words as far as practicable*

**Group-A (Very Short Answer Type Question)**

1. Answer any ten of the following : [ 1 x 10 = 10 ]

- (i) At resonance, the circuit is resistive with zero power factor and the current, voltage are in phase. Mention either the statement is correct or incorrect.
- (ii) The time constant of an RL circuit \_\_\_\_\_.
- (iii) A sinusoidal input function will produce an oscillatory response in an RLC circuit. State whether it is true or false.
- (iv) The conditions to be satisfied for the Fourier series of a function to exist are called \_\_\_\_\_.
- (v) A passive filter is constructed from \_\_\_\_\_ elements.
- (vi) When the maximum power is transferred, the efficiency of the circuit is \_\_\_\_\_.
- (vii) When a series RL circuit is connected to a voltage source  $V$  at  $t=0$ , the current passing through the resistor at steady-state is \_\_\_\_\_.
- (viii) For a physically realizable circuit, the impulse response is \_\_\_\_\_.
- (ix) The Fourier series expansion of a periodic signal having \_\_\_\_\_ symmetry contains odd harmonics only.
- (x) The ratio of the current transform at one port to voltage transform at another port is called \_\_\_\_\_.
- (xi) For the circuit shown in figure, Thevenin's voltage and equivalent resistance at terminal a-b is \_\_\_\_\_.



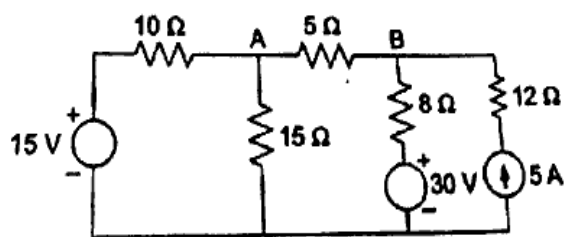
- (xii) When a series RC circuit is connected to a voltage source  $V$  at  $t=0$ , the current passing through the resistor at steady-state is \_\_\_\_\_.

**Group-B (Short Answer Type Question)**

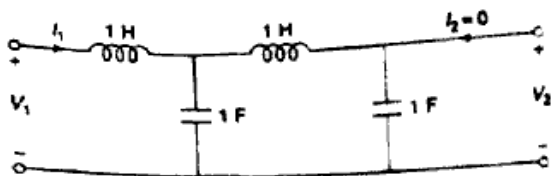
Answer any three of the following :

[ 5 x 3 = 15 ]

2. Find the Laplace Transform of  $f(t) = e^{4t} \sin^3 t$  [5]
3. Find the value of  $R$  if the average power dissipated in the resistor is 2000 W, if the voltage has the following Fourier series: [5]  
 $V(t) = 400 \sin(\omega t) + 300 \sin(3\omega t) + 100 \sin(5\omega t)$
4. A series RLC circuit which resonates at 500 KHz has  $R = 25 \text{ ohm}$ ,  $L = 100 \text{ uH}$  and  $C = 1000 \text{ pF}$ . Determine the  $Q_0$ . Also calculate  $C$ ,  $Q_0$  for doubled value of  $L$ . [5]
5. Find the voltage across the 5 ohm resistance in the Figure using Superposition Theorem. [5]



6. For the network shown in figure, determine  $V_1/I_1$ ,  $V_2/V_1$ . [5]



**Group-C (Long Answer Type Question)**

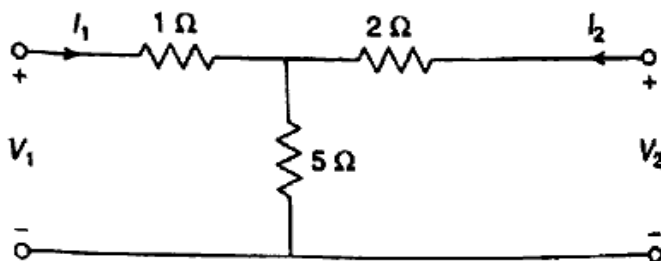
Answer any three of the following :

[ 15 x 3 = 45 ]

[ 3 ]

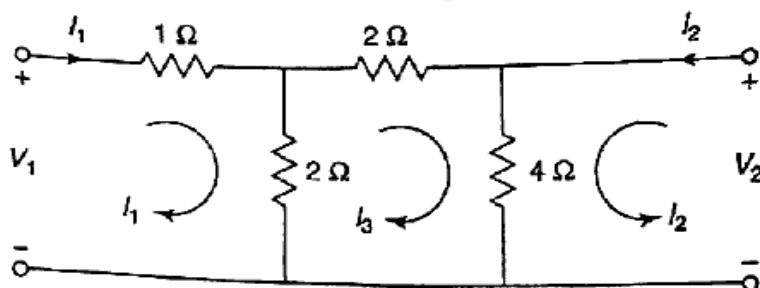
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7. (a) What are transmission parameters? Where are they most effectively used?  
(b) Calculate the ABCD parameters of the network shown in figure.



[ 6 ]

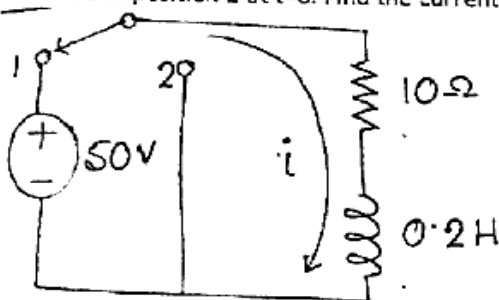
- (c) Find the hybrid parameters of the circuit given below.



8. (a) State and prove the time shifting and frequency shifting property in the context of Laplace Transformation. <https://www.makaut.com>  
(b) In the series RL circuit, the switch is in position 1 long enough to establish the steady-state and is switched to position 2 at  $t=0$ . Find the current using Laplace Transformation.

[ 7 ]

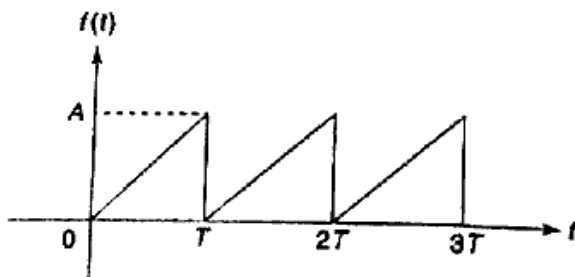
[ 6 ]



- (c) State the initial value theorem in the context of Laplace Transform.  
9. (a) Find the Laplace Transformation of the waveform shown in figure.

[ 2 ]

[ 6 ]



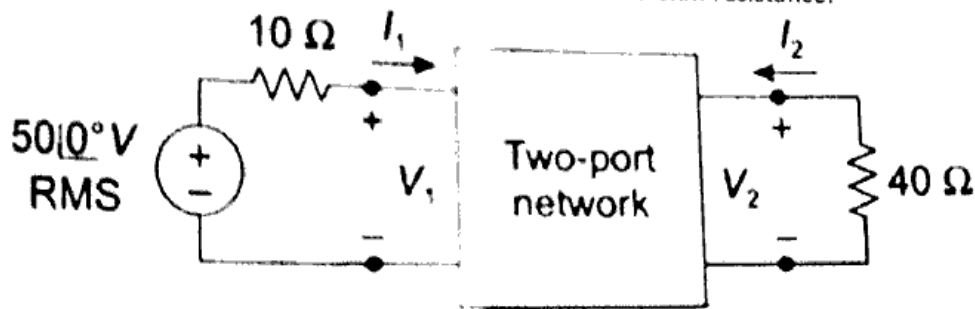
- (b) Find the Inverse Laplace Transformation of  $(s^2 - 15s - 11)/\{(s+1)(s-2)^2\}$   
(c) State and prove the final value theorem in the context of Laplace Transformation.  
10. (a) Derive the expression of the RLC parallel resonance for AC excitation.

[ 5 ]

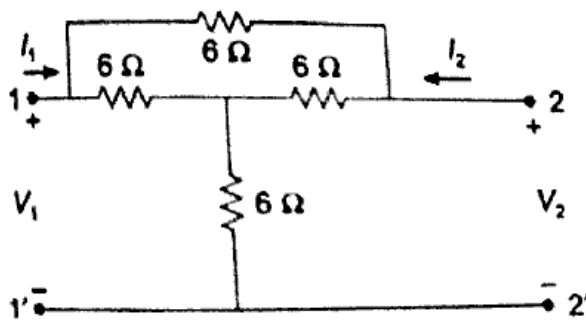
[ 4 ]

[ 5 ]

- (b) Prove that the Bandwidth of a series RLC circuit is  $R/L$ . [5]  
 (c) A parallel RLC circuit has a quality factor of 50 at unity power factor and operates at 1 kHz and dissipates 2W when driven by 2 A (rms) at 1kHz. Find bandwidth and numerical values of R, L and C. [5]  
 11. (a) If  $Z_{11} = 30 \text{ ohm}$ ,  $Z_{12} = 10 \text{ ohm}$ ,  $Z_{21} = 15 \text{ ohm}$ ,  $Z_{22} = 20 \text{ ohm}$ , for the two-port network shown in figure, calculate the average power delivered to the 40 ohm resistance. [8]



- (b) Find the Z-parameters of the two-port network shown in figure below. [7]



\*\*\* END OF PAPER \*\*\*

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