

CS/B.Tech/EE/EEE/ICE/PWE/Odd/Sem-3rd/EE-301/2014-15

EE-301

ELECTRIC CIRCUIT THEORY

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. Answer any ten questions. 10 × 1 = 10
 - (i) A circuit having neither an emf source nor any energy source is
(A) active circuit (B) passive circuit (C) unilateral circuit (D) bilateral circuit
 - (ii) If a function $f(t)$ is shifted by T , then it is correctly represented as
(A) $f(t - T)u(t)$ (B) $f(t - T)u(t - T)$ (C) $f(t)u(t - T)$ (D) $(t - T)f(t - T)$
 - (iii) A two port network is defined by the relations $I_1 = 2V_1 + V_2$ and $I_2 = 2V_1 + 3V_2$, then Z_{12} is
(A) -2 ohm (B) -1 ohm (C) $-\frac{1}{2}$ ohm (D) $-\frac{1}{4}$ ohm
 - (iv) When a number of two port networks is connected in cascade, the individual
(A) Z matrices are added (B) Y matrices are added
(C) T matrices are multiplied (D) H matrices are multiplied
 - (v) A periodic signal $f(t)$ repeats itself after half time period. It will possess only
(A) sine terms (B) cosine terms (C) odd harmonics (D) even harmonics
 - (vi) A low pass filter with a cut-off frequency of 30 Hz is cascaded with a high pass filter with a cut-off frequency of 20 Hz. The resultant system of filters will function as
(A) an all pass filter (B) an all stop filter
(C) a band stop (band reject filter) (D) a band stop filter
 - (vii) The Laplace transformation of $f(t)$ is $F(s)$. Given $F(s) = \omega / (s^2 + \omega^2)$, the final value of $f(t)$ is
(A) infinity (B) zero (C) one (D) none of these

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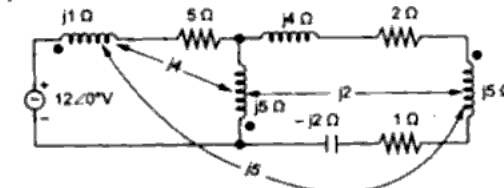
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- (viii) The Laplace transform of a shifted unit step $f(t) = U(t - a)$ is
(A) e^{-as} (B) $e^{-as} - 1$ (C) se^{-as} (D) $s(1 - e^{-as})$
- (ix) The time constant of the network shown in the figure is
(A) $2RC$ (B) $3RC$
(C) $RC/2$ (D) $2RC/3$
- (x) Maximum Power transfer occurs at a
(A) 100% efficiency (B) 50% efficiency (C) 25% efficiency (D) 75% efficiency
- (xi) The Thevenin's equivalent resistance of the given circuit with respect to the terminals A and B is equal to
(A) 2.66Ω (B) 3.2Ω
(C) 8Ω (D) 12Ω
- (xii) The number of links for a graph having n nodes and b branches are
(A) $b - n + 1$ (B) $n - b + 1$ (C) $b + n - 1$ (D) $b + n$

GROUP B
(Short Answer Type Questions)

Answer any three questions.

2. Find H matrix of a π network. $Z_{12} = 2 \Omega$, $Z_{10} = 1 \Omega$, $Z_{20} = 3 \Omega$.
3. Define Fourier transform. How does Fourier transform differ from Laplace transform?
4. Draw the circuit diagram of a 1st order HP filter and find out the cut-off frequency.
5. Write the mesh equations of the circuit shown in figure



6. Draw the graph corresponding to the given incidence matrix:

-1	0	0	0	1	0	1	0
0	-1	0	0	0	0	-1	1
0	0	-1	-1	0	-1	0	-1
0	0	0	0	-1	1	0	0
1	1	1	1	0	0	0	0

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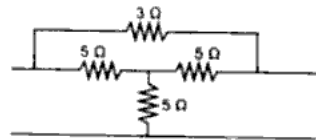
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GROUP C
(Long Answer Type Questions)

Answer any three questions.

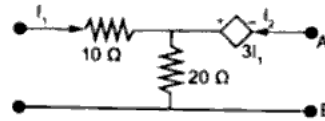
7. (a) Obtain the Y parameters of the network shown.



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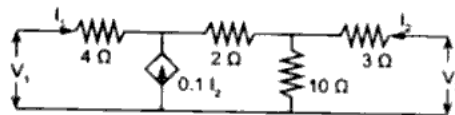
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- (b) Find the transmission parameters for the two-port network shown.



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- (c) Find the Z parameter for the network shown in the figure. Hence find the H parameter for the same network.

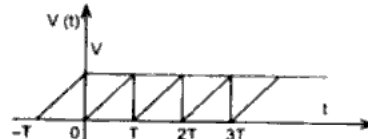


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8. (a) Explain with example, odd symmetry and even symmetry of periodic waveforms.

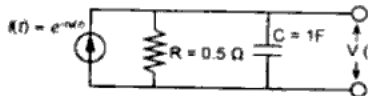
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- (b) Obtain the Fourier series expansion of the sawtooth voltage shown.



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- (c) Determine the output voltage across the capacitor if the excitation is a current source of $i(t) = e^{-t}u(t)$.



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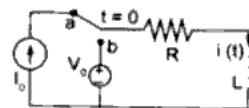
9. (a) Find $L^{-1}\{F_1(s)F_2(s)\}$ by using convolution of the following functions :

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$$F_1(s) = \frac{1}{s+1} \text{ and } F_2(s) = \frac{1}{s+2}$$

- (b) In the circuit shown, the switch moves from position a to position b at $t = 0$. Find $i(t)$ for $t > 0$.

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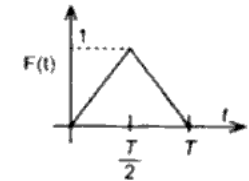


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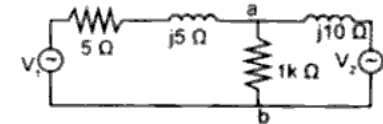
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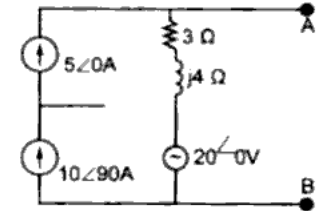
- (c) Find the Laplace transform of the triangular waveform shown in the figure.



10. (a) In the network, two sources acting separately produce equal currents in the branch $a-b$. Find the ratio V_1/V_2 (use superposition theorem).



- (b) Convert the active network shown in the figure to a single voltage source in series with impedance.

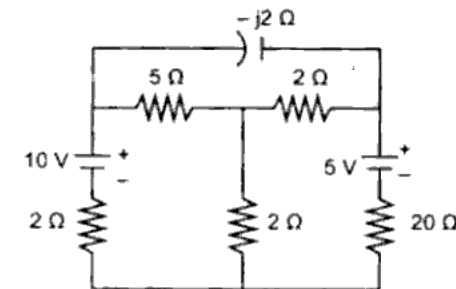


- (c) Two sources $5\cos(\omega t + 30^\circ)$ and $2\cos(\omega t)$ are connected across Z_L . Their internal impedances are $(3+j2)\Omega$, $(4-j3)\Omega$. Find Z_L for maximum power transfer condition.

11. (a) What is oriented graph of a network? Explain with a suitable example.

- (b) Develop at least three trees for your considered network. Mark the twigs and links.

- (c) For the network shown in figure below draw the oriented graph, develop the incidence matrix, choose a tree and considering the tree develop the tie-set matrix



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