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

i) A tie-set matrix has 3 rows and 7 branches. The number of twigs is

a) 3 b) 5

c) 2 d) 4.

ii) If a function 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) If all the elements in a particular network are linear, then the superposition theorem would hold, when the excitation is

a) *DC* only b) *AC* only

c) either *AC* or *DC* d) an Impulse.

iv) In balanced bridge, if the positions of detector and source are interchanged, the bridge will still remain balanced. This can be explained from which theorem ?

a) Reciprocity theorem

b) Thevenin's theorem

c) Norton's theorem

d) Compensation theorem.

v) When we use super node technique

a) Current source branch is common for two meshes

b) Ideal voltage source is connected between two non-reference nodes

c) Ideal voltage source is connected between non-reference node and reference

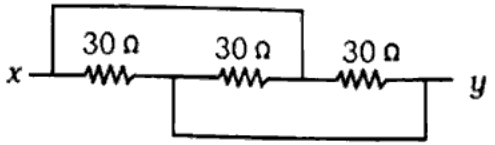
d) All of these.

vi) The number of links of a graph having n nodes and b branches are

a) $b-n+1$ b) $b+n-1$

c) $n-b+1$ d) $b+n$.

vii) The equivalent resistance between x & y of the figure shown below is



a) 30 ohm b) 50 ohm

c) 60 ohm d) 10 ohm.

viii) A network with 5 independent loops and 7 nodes will have number of branches in the network

a) 10 b) 7

c) 4 d) none of these.

ix) A current in a circuit is given by, $I(S) = \frac{2s+8}{s^2+4s+12}$. If the current flows through a 5Ω resistor, power dissipated at $t = 0$ is

a) 20 watt b) 15 watt

c) 40 watt d) 10 watt.

x) A network is linear if

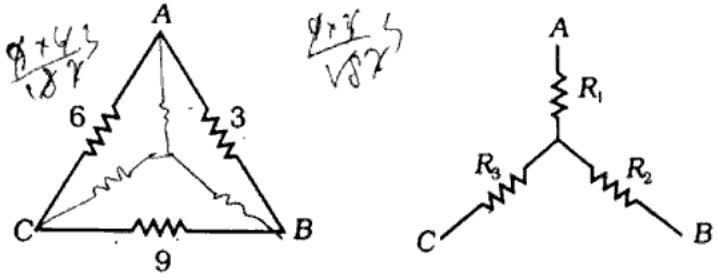
a) Response proportional to excitation function

b) Principle of superposition applies

c) Principle of homogeneity applies

d) Both (b) and (c).

xi) The resistances R_1, R_2 and R_3 are respectively



a) 1, 3/2 & 3 b) 3, 3/2 & 6

c) 9, 3 & 1 d) 2, 1 & 9.

xii) If poles and zeros are arranged alternatively on imaginary axis, then type of network is

a) LC network b) RC network

c) RL network d) Any of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Find v_x using source transformation technique in the given Fig.1.

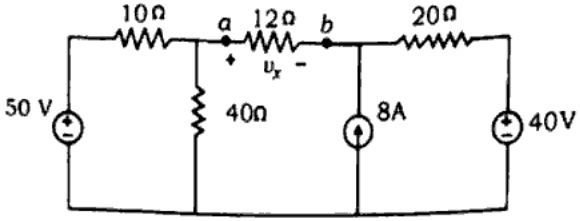


Fig.-1.

3. Apply superposition principle to find v_0 and in the Fig. 2.

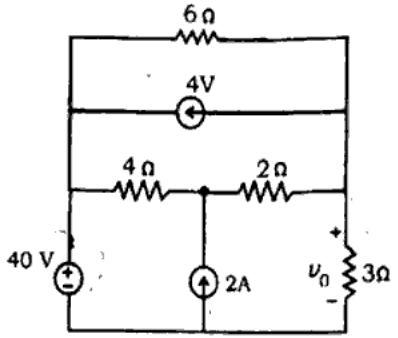


Fig.-2.

4. Find the incidence matrix of the given network in Fig. 3.

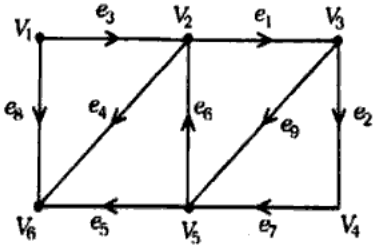


Fig.-3.

5. Find Norton equivalent circuit across *a* & *b* terminals from the Fig. 4.

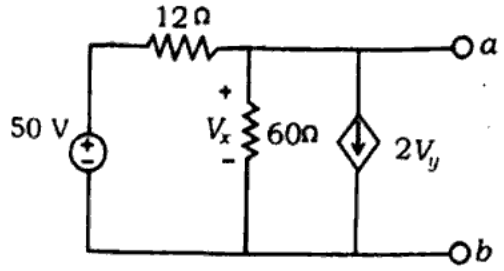


Fig.-4.

6. Find the Laplace transform of the periodic function in Fig. 5.

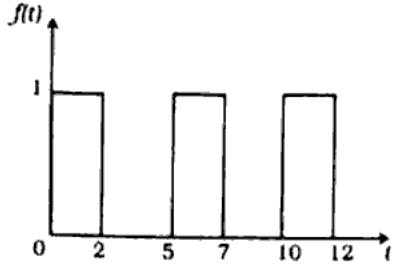


Fig.-5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Find Thevenin equivalent at terminals a – b of the network in Fig. 6. 9

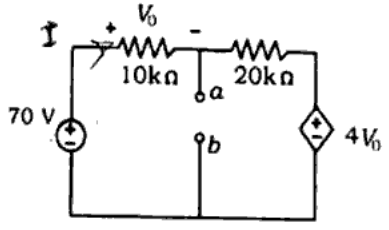


Fig.-6.

b) Determine the Laplace transform of

$f(t) = t^2 * \sin(2t) * u(t)$. 6

8. a) Solve for V_0 using mesh analysis in Fig. 7. 8

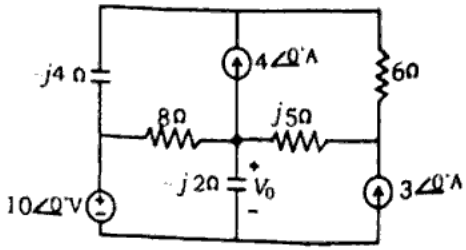
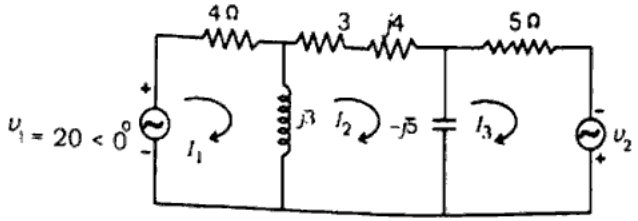


Fig.-7.

b) Determine the value of v_2 such that the current through impedance $(3 + j4)\Omega$ is zero.



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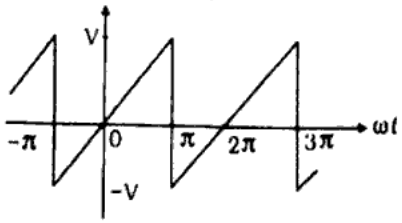
9. a) Find the Fourier expansion of the following waveform shown in figure.



b) Determine the Fourier transform and sketch the amplitude and phase and phase spectrums of the functions

$f(t) = Ve^{-t/a}$ for $t \geq 0$

$= 0$ for $t \leq 0$ 8 + 7

10. Find out the fundamental cut-set matrix and fundamental tie-set matrix of Fig. 8.

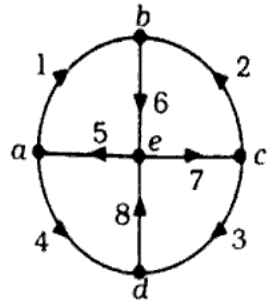


Fig. 8

11. a) A 2nd order active filter is shown in the Fig. 9 find out the transfer function of the filter and show that it is a low-pass filter. 9

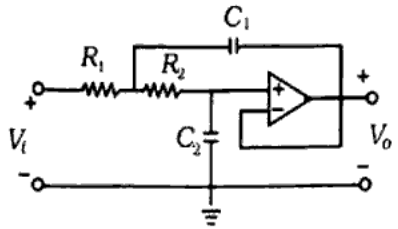


Fig. 9

b) Design a high-pass filter with a high frequency gain of 5 and a corner frequency of 2 kHz. Use a 0·1 μF capacitor in your design. 6