Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/EE(N) /EEE(N)/PWE(N)/ICE(N)/SEM-3/EE-301/2012-13

2012

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.

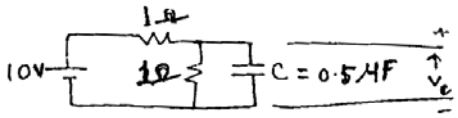
GROUP – A

(Multiple Choice Type Questions)

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

   i) The internal impedance of an ideal voltage source should be
      a) zero
      b) infinite
      c) greater than zero but less than infinity
      d) none of these.

   ii) The steady state voltage V_c in this given figure is



      a) 10 V b) 15 V
      c) 5 V d) none of these.

iii) What is the condition for reciprocity in term of h parameters ?

a) $h_{11} = h_{22}$ b) $h_{21}h_{12} = h_{11}h_{12}$

c) h_{12} & $h_{21} = 0$ d) $h_{12} = h_{21}$.

iv) An ideal filter should have

a) zero attenuation in the pass band

b) zero attenuation in the attention band

c) infinite attenuation in the pass band

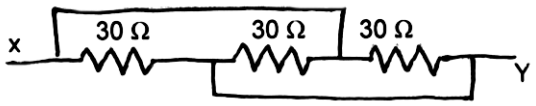
d) none of these.

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

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

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

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



a) 30 Ω b) 50 Ω

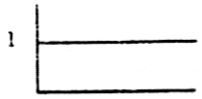
c) 60 Ω d) 10 Ω.

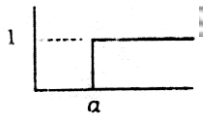
vii) A Periodic Waveform having halfwave symmetry has no

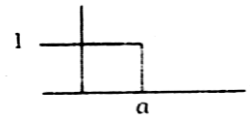
a) odd harmonics b) even harmonics

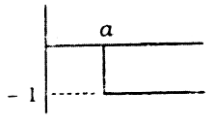
c) cosine terms d) sine terms.

viii) Graphical representation of $u(a-t)$ is

a) 

b) 

c) 

d) 

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

a) 3 b) 5

c) 2 d) 4.

x) Inverse Laplace of $F(s)=\dfrac{2}{s(s+1)}$ is

a) $2+e^{-2t}$ b) $1+2e^{-t}$

c) $2+2e^{-t}$ d) $2-2e^{-t}$.

xi) Two networks can be dual when

a) their nodal equations are same

b) the loop equations of one network are the nodal equations of the other

c) their loop equations are same

d) none of these.

xii) The *dc* gain of a system having the transfer function $H(s)=\dfrac{12}{(s+2)(s+3)}$ is

a) 2 b) 1

c) 12 d) 3

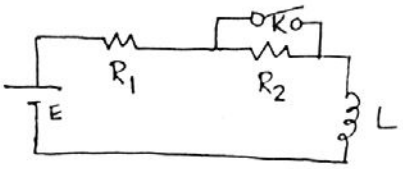
e) 0.

GROUP – B

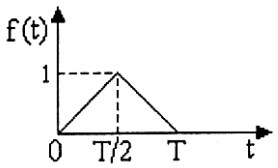
(Short Answer Type Questions)

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

2. In the figure given below the battery voltage is applied for a steady state period. Obtain the *q* complete expression for the current for the current after closing the switch *K*. Assume $R_1 = 1\Omega,\ R_2 = 2\Omega,\ L = 1H, E = 10\,\text{V}$.



3. Find the Laplace transform of the triangular waveform shown in the figure :

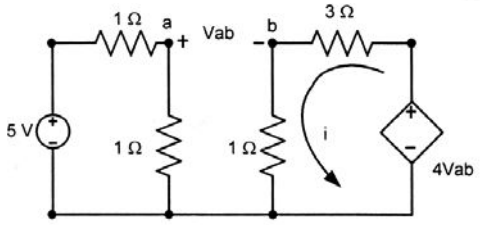


4. Find the *y*-parameters for the following networks shown in the figure :

5. Define incident matrix of a graph and draw the orientation graph from the reduced incident matrix.

$$[A] = \begin{bmatrix} 0 & -1 & 1 & 1 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

6. For the circuit shown in the figure, find the value of the current i.



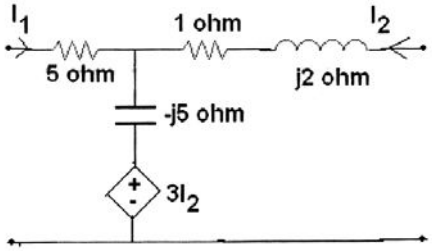
7. Explain under what condition, a RC series circuit behaves as
   i) Low-pass filter
   ii) Integrator.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

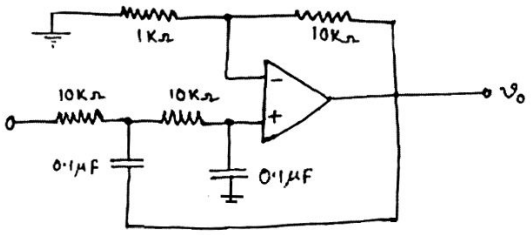
8. a) Find the *Z*-parameter and ABCD parameter of the circuit given below in the figure.



   b) Express *h*-parameter in terms of *Y*-parameter of a two port network.
   c) What is the cascade connection between two 2-port networks ? Explain with diagram. 7 + 4 + 4

9. a) Draw the circuit diagram of a first order high pass filter and find out the expression for the cut-off frequency.
   b) Draw and explain the characteristics of an ideal band-pass and an ideal band-stop filter.

c) The circuit shown in the figure is a second order low-pass filter. Analyze the circuit and find out the cutt-off frequency.

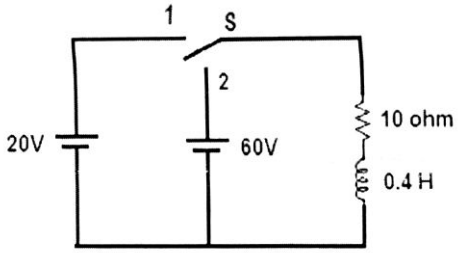


5 + 5 + 5

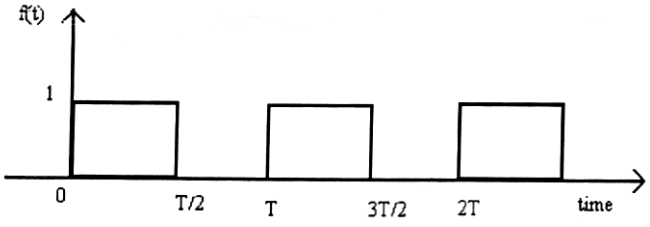
10. a) Find the inverse Laplace of $F(s)$.

$$F(s) = \frac{s+1}{s(s^2+4s+4)}$$

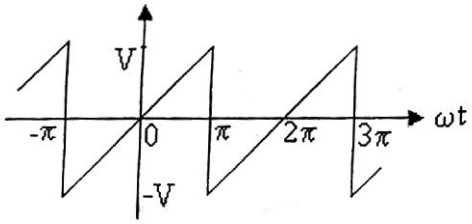
b) The circuit in the figure was in steady state with switch in position 1. Find current $i(t)$ for $t > 0$ if the switch is moved from position 1 to 2 at $t = 0$.



c) Determine the Laplace transform of the periodic square pulse train of amplitude as shown in the figure.



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



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

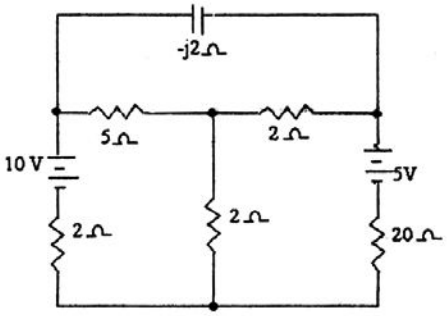
$f(t) = Ve^{-t/a}$ for $t \geq 0$

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

12. 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 in figure, draw the oriented graph, develop the incidence matrix, choose a tree and considering the tree develop the tie-set matrix.



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