



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.*

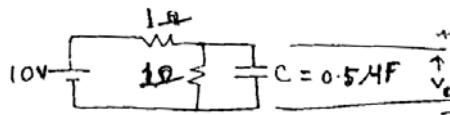
**GROUP – A**

**( 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)  $h_{21}h_{12} = h_{11}h_{22}$   
 c)  $h_{12} \text{ \& } h_{21} = 0$                 d)  $h_{12} = h_{21}$ .

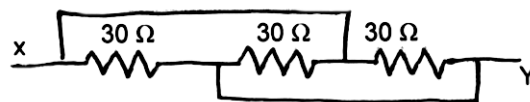
iv) An ideal filter should have

- 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)  $b + n$ .

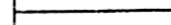
vi) The equivalent resistance between  $x$  &  $y$  of the figure shown below is





- a)  $30 \Omega$                               b)  $50 \Omega$   
 c)  $60 \Omega$                               d)  $10 \Omega$ .

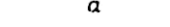
vii) A Periodic Waveform having halfwave symmetry has no

- a) odd harmonics                      b) even harmonics  
 c) cosine terms                        d) sine terms.

a) 

b) 

c) 

d) 

a) 3                      b) 5  
c) 2                      d) 4.

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

- their nodal equations are same
- the loop equations of one network are the nodal equations of the other
- their loop equations are same
- none of these.

$$H(s) = \frac{12}{(s+2)(s+3)}$$

a) 2                                  b) 1  
c) 12                                 d) 3  
e) 0.



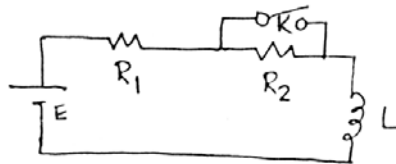
**GROUP – B**

**( Short Answer Type Questions )**

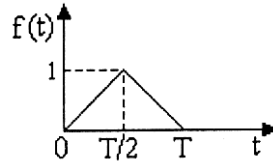
Answer any *three* of the following

$3 \times 5 = 15$

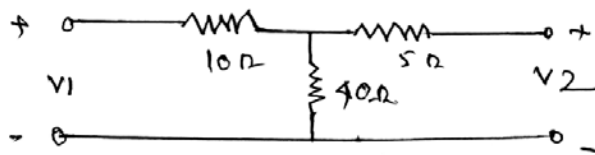
2. In the figure given below the battery voltage is applied for a steady state period. Obtain the  $q$  complete expression for the current for the current after closing the switch  $K$ . Assume  $R_1 = 1\Omega$ ,  $R_2 = 2\Omega$ ,  $L = 1H$ ,  $E = 10V$ .



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 :

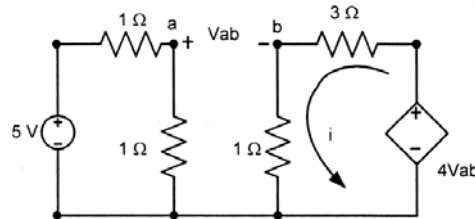


5. Define incident matrix of a graph and draw the orientation graph from the reduced incident matrix.

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



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



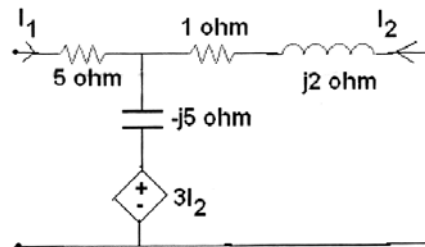
7. Explain under what condition, a RC series circuit behaves as
- Low-pass filter
  - Integrator.

### GROUP – C

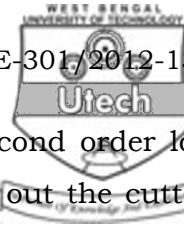
#### ( Long Answer Type Questions )

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

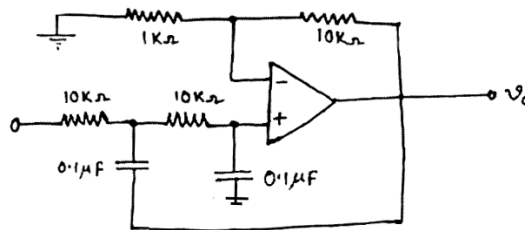
8. a) Find the Z-parameter and ABCD parameter of the circuit given below in the figure.



- Express  $h$ -parameter in terms of Y-parameter of a two port network.
  - 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.
- 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 cut-off frequency.

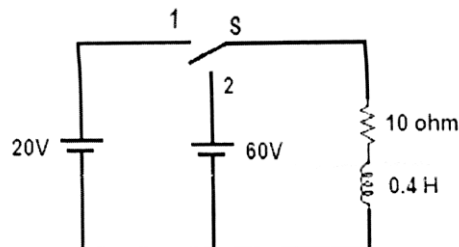


5 + 5 + 5

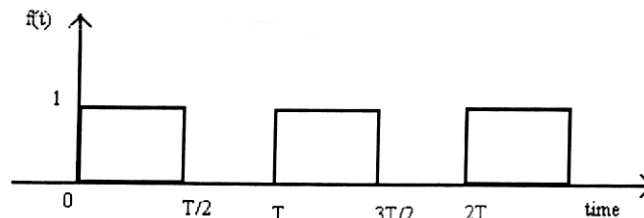
10. a) Find the inverse Laplace of  $F(s)$ .

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

- 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  $t = 0$ .

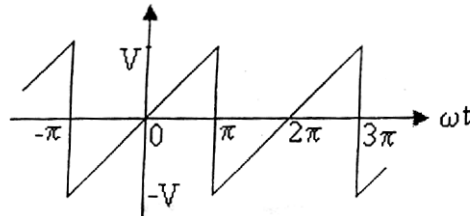


- c) Determine the Laplace transform of the periodic square pulse train of amplitude as shown in the figure.





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



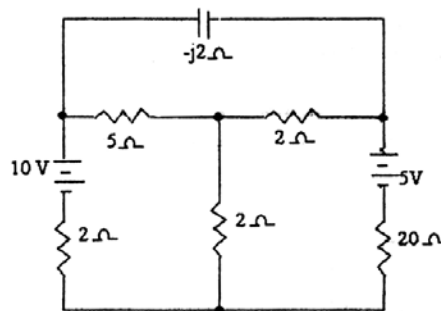
- b) Determine the Fourier transform and sketch the amplitude and phase spectrums of the function

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

$$= 0 \text{ for } t \leq 0$$

$$8 + 7$$

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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