



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH (OLD)/CSE/IT/ECE/EE/ICE/BME/  
PWE/EEE/SEM-3/EE-301/2012-13**

**2012**

**CIRCUIT THEORY AND NETWORKS**

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) If the voltage across a given capacitor is increased, the amount of stored charge
    - a) increases
    - b) decreases
    - c) remains constant
    - d) is exactly doubled.
  - ii) When the frequency of applied voltage in a series RL circuit is increased what happens to the inductive reactance ?
    - a) Decreases
    - b) Remains the same
    - c) Increases
    - d) Becomes zero.
  - iii) Mesh analysis is based on
    - a) Kirchhoff's current law
    - b) Kirchhoff's voltage law
    - c) both (a) and (b)
    - d) none of these.

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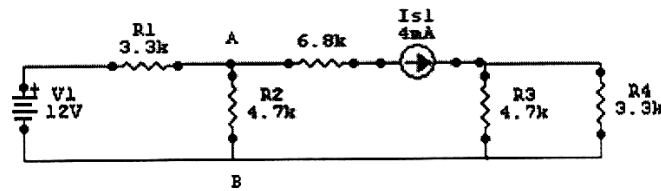
**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

$3 \times 5 = 15$

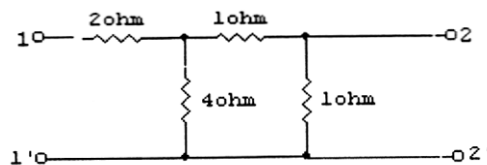
2. For the network shown in the figure, calculate the current in the branch  $AB$  using superposition theorem.



3. Find the inverse Laplace Transform of the function

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

4. What is an active filter ? Give the advantages and disadvantages of an active filter over a passive filter.
5. Define incidence matrix. The reduced incidence matrix of an oriented graph is  $[A] = \begin{bmatrix} 0 & -1 & 1 & 1 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$ . Draw the graph.
6. Find the  $y$ -parameters of the resistive network of the figure shown below.



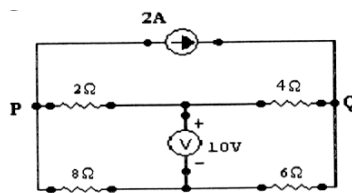


**GROUP – C**

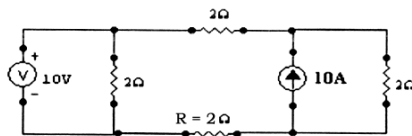
**( Long Answer Type Questions )**

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

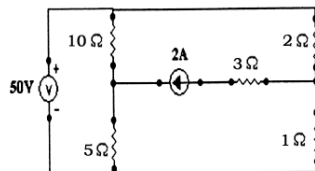
7. a) Using source transformation and simplification, determine the voltage between the points  $P$  &  $Q$  shown in figure.



- b) Find the voltage across the resistor  $R = 2\Omega$  in given figure.

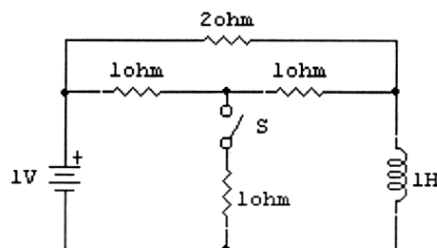


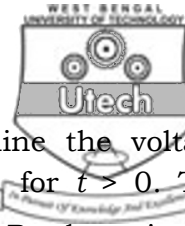
- c) Find the current through the  $5\Omega$  resistor in given figure, using mesh analysis.



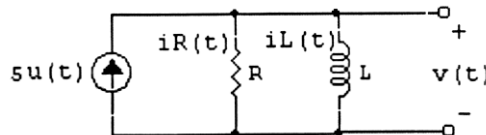
$5 + 5 + 5$

8. a) The circuit shown in figures below is initially in the steady state with the switch  $S$  open. At  $t = 0$ , the switch  $S$  is closed. Obtain the current in the inductor for  $t > 0$ .

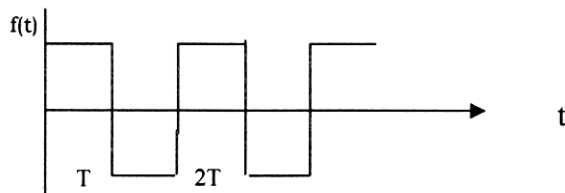




- b) In the circuit of figure below, determine the voltage  $V(t)$  and the circuit  $i_R(t)$  and  $i_L(t)$  for  $t > 0$ . The circulating current at  $t = 0$  in the  $R_L$  loop is 1A clockwise.

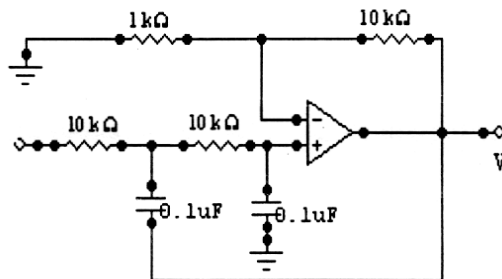


- c) Show that the Laplace Transform of a periodic function  $f(t)$  of period  $T$  is  $F(s) = [1/(1 - e^{-sT})] F_1(s)$ , where  $F_1(s)$  is the Laplace Transform of  $f(t)$  if it existed from  $t = 0$  to  $t = T$ . Determine the Laplace Transform of the following waveforms  $f(t)$  of figure shown below.



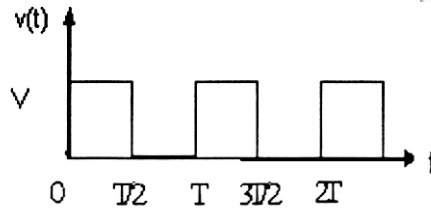
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9. a) Draw the circuit diagram of a first order low pass active filter and find out the expression of the cut-off frequency.
- b) The circuit shown in figure below is a second order low pass filter. Analyze the circuit and find out the cut-off frequency.



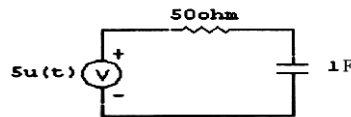


- c) Find the Fourier series for the train of pulses shown in figure shown below.

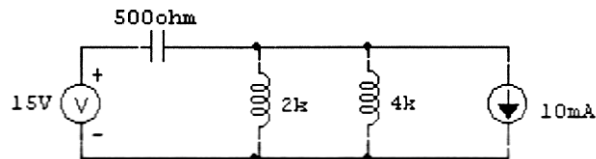


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10. a) Write the input file in SPICE to plot the capacitor voltage and capacitor current (initial voltage for the capacitor is 1 volt) in the circuit given in the figure.



- b) Write SPICE input file for the circuit shown in the figure below.



- c) Write advantages and disadvantages of P-Spice.

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