



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 × 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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- I. $h_{12} = -h_{21}$

II. $Z_{12} = Z_{21}$

a) I & II b) I & III
c) II & III d) I, II & III.

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- a) e^{-as}/s b) e^{-bs}/s^2
c) $(e^{-as} + e^{-bs})/s$ d) $(e^{-as} - e^{-bs})/s$.

- a) $4 \times 10^{-6} \text{ A}$
c) zero
- b) $10^6 / 4 \text{ A}$
d) 4 A .

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



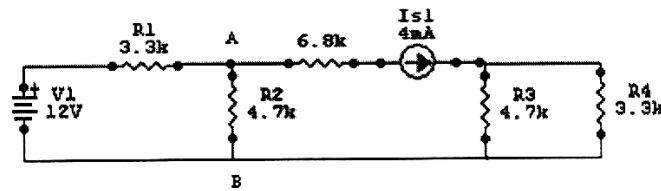
GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

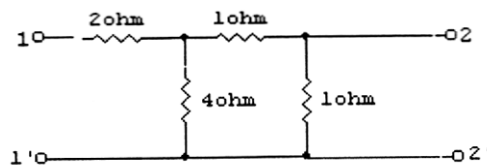
2. For the network shown in the figure, calculate the current in the branch AB using superposition theorem.



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.



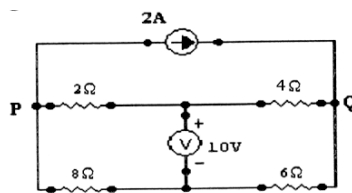


GROUP – C

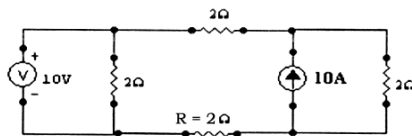
(Long Answer Type Questions)

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

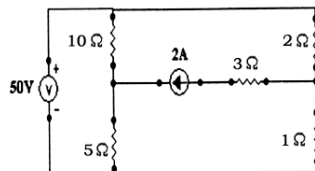
7. a) Using source transformation and simplification, determine the voltage between the points P & Q shown in figure.



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

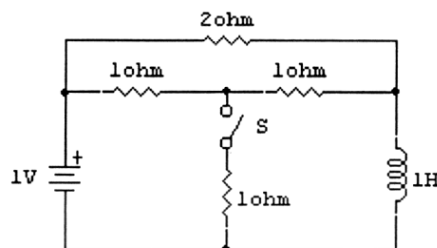


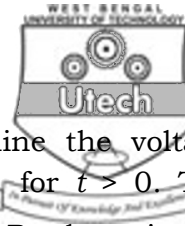
- c) Find the current through the 5Ω resistor in given figure, using mesh analysis.



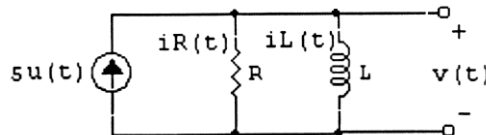
$5 + 5 + 5$

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 $t > 0$.

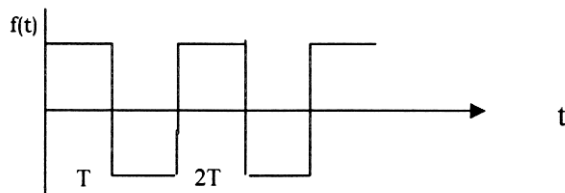




- b) In the circuit of figure below, determine the voltage $V(t)$ and the circuit $i_R(t)$ and $i_L(t)$ for $t > 0$. The circulating current at $t = 0$ in the R_L loop is 1A clockwise.

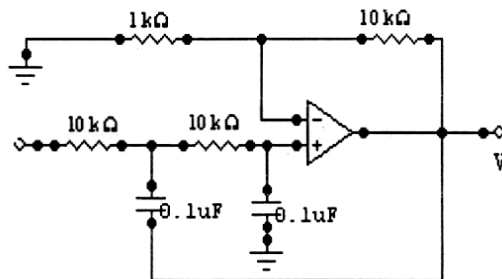


- c) Show that the Laplace Transform of a periodic function $f(t)$ of period T is $F(s) = [1/(1 - e^{-sT})] F_1(s)$, where $F_1(s)$ is the Laplace Transform of $f(t)$ if it existed from $t = 0$ to $t = T$. Determine the Laplace Transform of the following waveforms $f(t)$ of figure shown below.



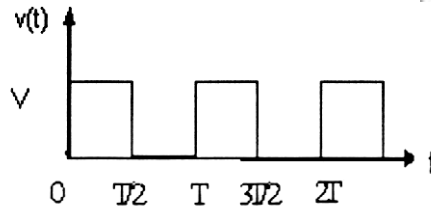
5 + 5 + 5

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.



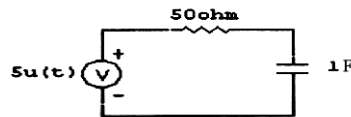


- c) Find the Fourier series for the train of pulses shown in figure shown below.

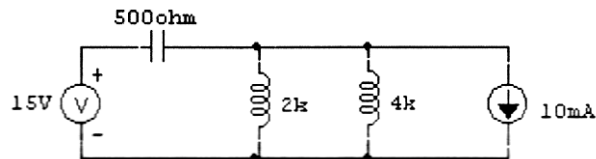


5 + 5 + 5

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.

5 + 5 + 5

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