ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2008

CIRCUIT THEORY & NETWORKS

SEMESTER - 3

Time : 3 Hours] [Full Marks : 70

GROUP - A

(Multiple Choice Type Questions)

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

i) Maximum power transfer occurs at efficiency of

a) 100% b) 50%

c) 25% d) 75%.

ii) A periodic waveform possessing half-wave symmetry has no

a) odd harmonics b) even harmonics

c) cosine terms d) sine terms.

iii) The impedance of an ideal current source should be

a) 0

b) infinite

c) greater than 0 but less than infinity

d) none of these.

iv) In R-L circuit, the phase angle difference between voltage & current is

a) 30° b) 90°

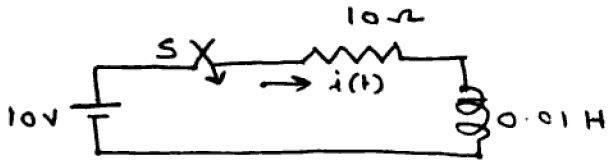
c) 180° d) greater than 0° but less than 90°.

v) Unit step function is first derivative of

a) ramp function b) impulse function

c) gate function d) parabolic function.

vi) After closing the switch 's' at $t = 0$, the current $i(t)$ at any instant 't' in the network shown



is given by

a) $10 + 10\,e^{100t}$ b) $10 - 10\,e^{100t}$

c) $10 + 10\,e^{-100t}$ d) $10 - 10\,e^{-100t}$.

vii) When compared to a first order low psss filter, a second order low pass filter has

a) lower voltage gain b) higher voltage gain

c) faster drop in filter response d) higher cut-off frequency.

viii) A cut set schedule gives relation between

a) branch currents & link currents

b) branch voltages & tree branch voltages

c) branch voltages & link voltages

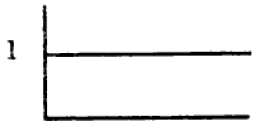
d) branch currents & tree currents.

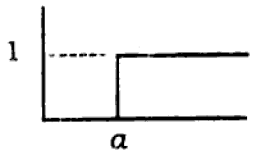
ix) The equation $Y = mx + c$ is

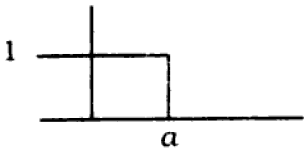
a) linear b) non-linear

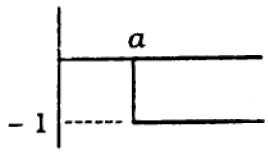
c) parabolic d) none of these.

x) Graphical representation of $u(a-t)$

a) 

b) 

c) 

d) 

xi) A two port network is reciprocal if & only if

a) $Z_{11} = Z_{22}$ b) $BC - AD = -1$

c) $Y_{12} = Y_{21}$ d) $h_{12} = h_{21}$.

xii) Given $V_{TH} = 20$ V & $R_{TH} = 5\Omega$, the current in the load resistance of a network is

a) 4A b) more than 4A

c) 4A or less d) less than 4A.

GROUP – B

(Short Answer Type Questions)

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

2. For an *RL* series circuit shown in the figure 1 with $R = 2\Omega$ & $L = 1$H and no initial current in the inductor. A voltage $V = 4e^{-t}$ volts is applied at $t = 0$. Find expression for the resulting current in the circuit for $t \geq 0$ using Laplace transform method.

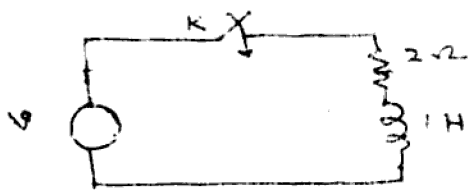


Figure 1

3. a) Define incidence matrix.

b) For the graph shown in figure 2, find the complete incidence matrix.

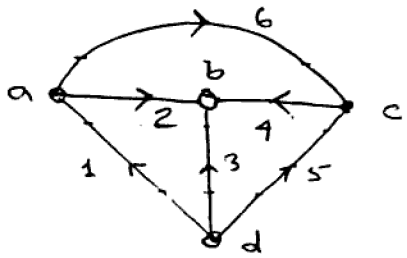


Figure 2 1 + 4

4. What should be the value of Z_2 for maximum power to be delivered in the circuit shown in fig. 3

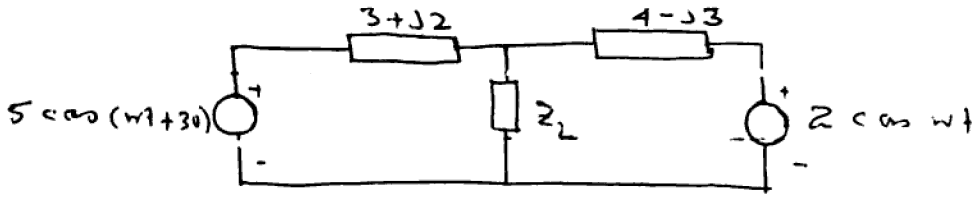


Figure 3

5. In a linear circuit consisting of $R = 9\Omega$ & $L = 8$ mH, a current.

$i = 5 + 100 \sin (1000t + 45^\circ) + 100 \sin (3000t + 60^\circ)$ amps is flowing. Find the equation of applied voltage.

6. Measurements were made on two terminal network shown in figure 4.

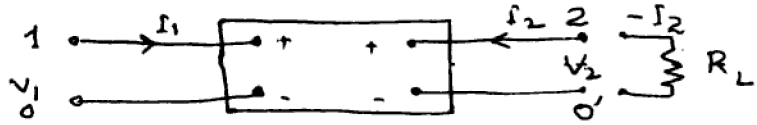


Figure 4

a) With terminal pair 2 open, a voltage of $100 < 0^\circ$ volts applied to terminal pair 1 resulted in $I_1 = 10 < 0^\circ$ amps & $V_2 = 25 < 0^\circ$ volts.

b) With terminal pair 1 open, the same voltage applied to terminal pair 2 resulted in $I_2 = 20 < 0^\circ$ amps & $V_1 = 50 < 0^\circ$ volts.

Write the loop equations for this network and also find the driving point & transfer impedances.

GROUP – C

(Long Answer Type Questions)

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

7. a) Solve the circuit current '*i*' shown in the figure 5 using Thevenin's theorem.

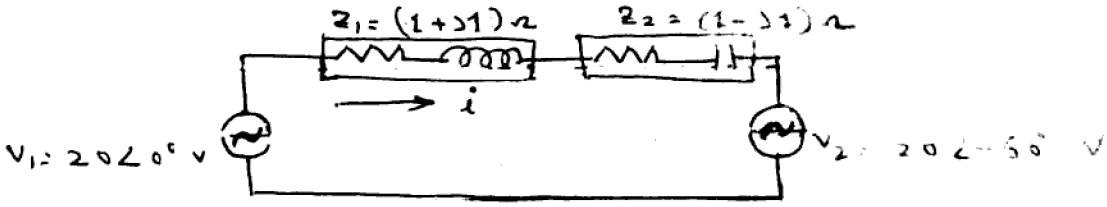


Figure 5

Verify the result obtained by Norton's theorem.

b) Obtain the output voltage V_0 across X - Y terminal for the circuit shown in figure 6.

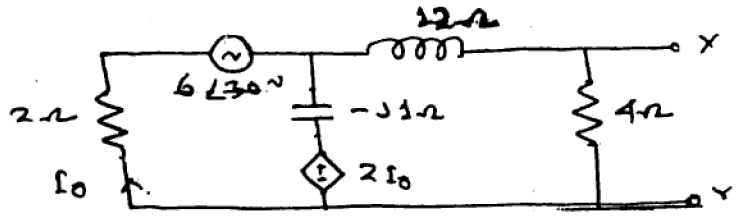


Figure 6

$10 + 5$

8. a) Find the Fourier series for the square wave shown in figure 7.

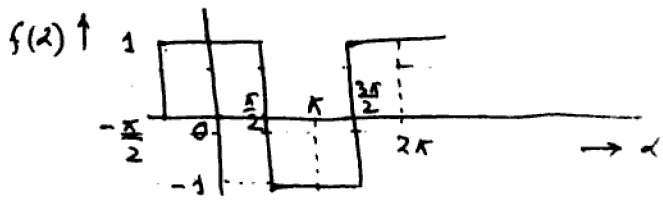


Figure 7

b) Find the Fourier transform of an exponential voltage waveform given by

$$v(t) = V_0 e^{-t} \text{ for } t \geq 0$$

$$= 0 \text{ for } t < 0.$$

10 + 5

9. a) What are transmission parameters ? Where are they most effectively used ?

b) Calculate the ABCD parameters of the network shown in figure 8.

c) Find the hybrid parameters of the circuit given in figure 9.

Dia.

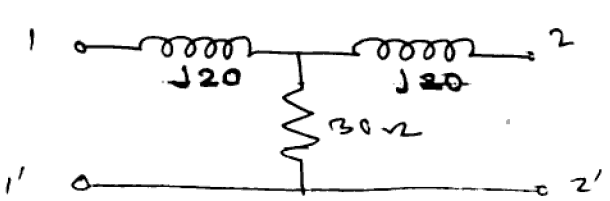


Figure 8

Dia.

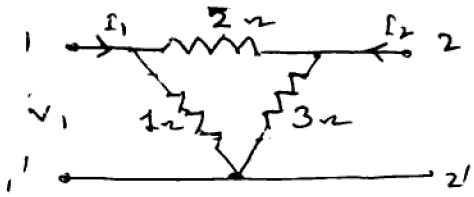


Figure 9

3 + 6 + 6

10. a) Differentiate between active and passive filters.

b) Find out the cut-off frequency of the following low-pass second order active filter shown in figure 10.

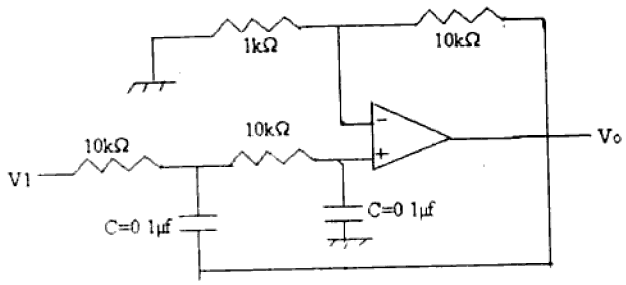


Figure 10

c) Draw the circuit diagram of a first order high-pass active filter and find out the expression of the cut-off frequency.

5 + 6 + 4

11. a) State superposition theorem. For the network shown in figure 11, calculate current throughout the impedance (3 + *j* 4) ohm using superposition theorem.

b) In the given circuit of figure 12, find the reading of the voltmeter *V*. Interchange the current source and voltmeter and verify the Reciprocity theorem.

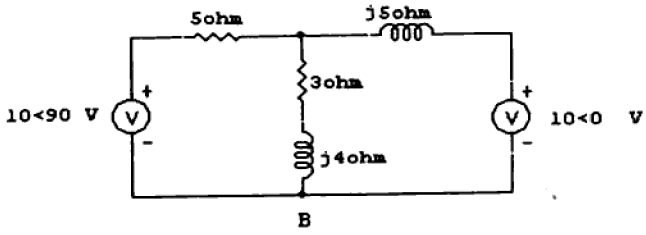


Figure 11

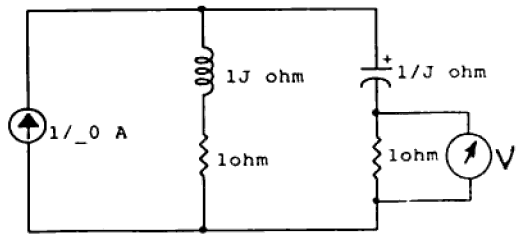


Figure 12

(2 + 6) + 7

END