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 × 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
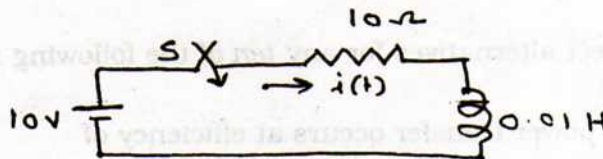
         a)   30°   b)   90°

         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.
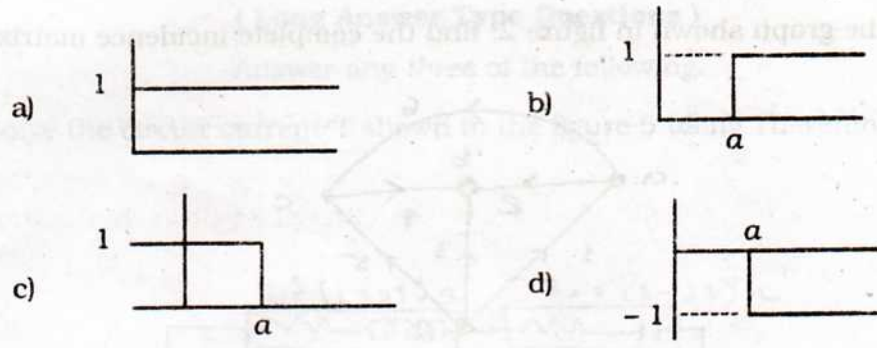
viii) A cut set schedule gives relation between

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 $R = 2\Omega$ & $L = 1H$ 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.
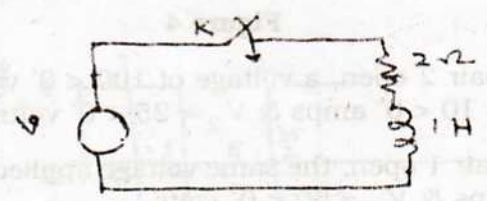
Figure 1

3. a) Define incidence matrix.

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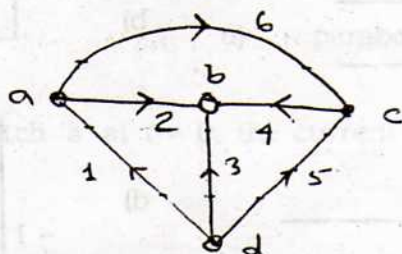

Figure 2

1 + 4

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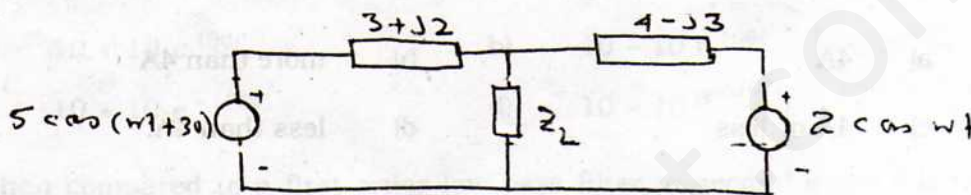

Figure 3

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

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

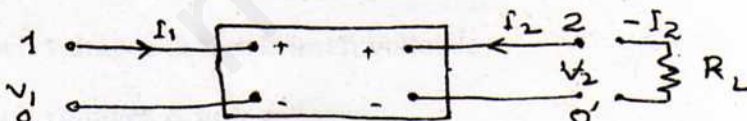6. Measurements were made on two terminal network shown in figure 4.

Figure 4

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

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

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

33301 (6/12)

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.
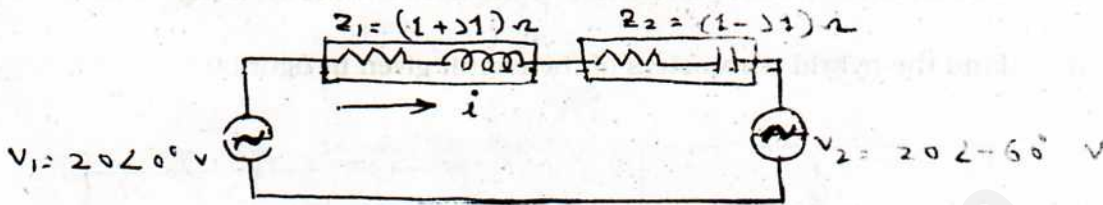
Figure 5

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.
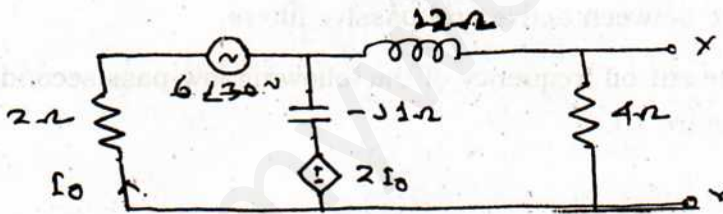
Figure 6 $10 + 5$

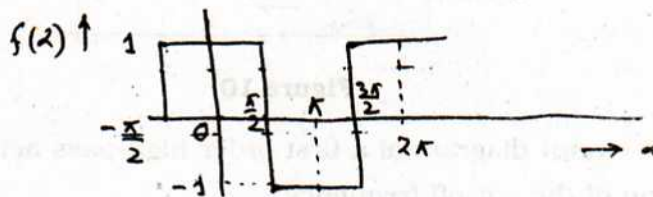8.   a)   Find the Fourier series for the square wave shown in figure 7.

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.

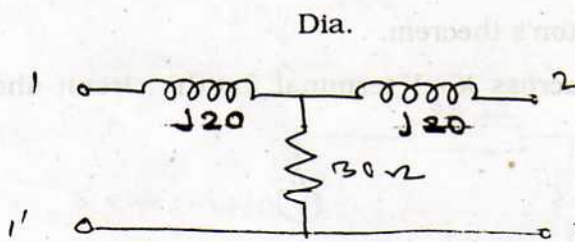c) Find the hybrid parameters of the circuit given in figure 9.
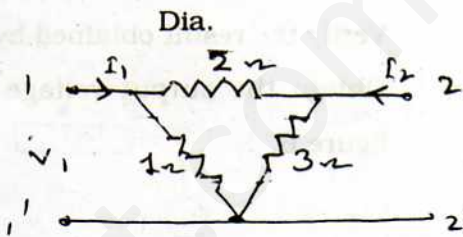
Dia.

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.
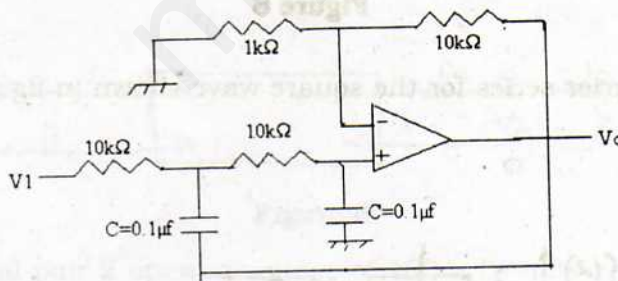

Figure 10

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 $(3 + j4)$ 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.
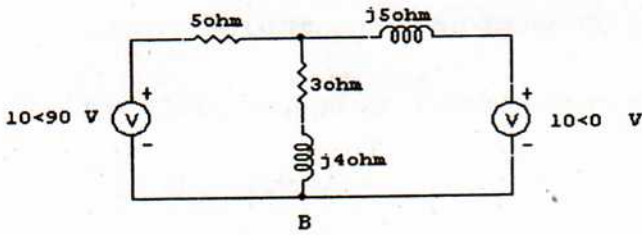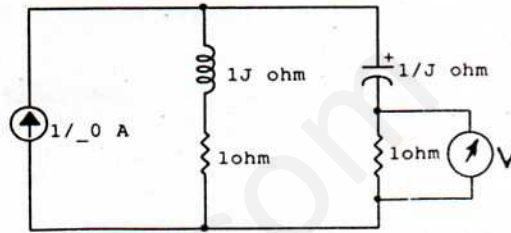
Figure 11   **Figure 12** $(2 + 6) + 7$

END