Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS / B.Tech / IT(N) / SEM-5 / IT-504A / 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 the following : 10 × 1 = 10

   i) Laplace transform analysis gives

   a) time domain response only

   b) frequency domain response only

   c) both (a) and (b)

   d) real response only.

   ii) If a function is shifted by T, then it is correctly represented as

   a) $f(t-T)u(t)$

   b) $f(t-T)u(t-T)$

   c) $f(t)u(t-T)$

   d) $(t-T)f(t-T)$.

iii) If $f(t)$ is an even function, then its Fourier transform $F(jw)$ is given by

a) $2\int_0^{\bullet} f(t)\cos wt\, dt$ b) $\int_0^{\bullet} f(t)\cos wt\, dt$

c) $2\int_0^{\bullet} f(t)\sin wt\, dt$ d) $\int_0^{\bullet} f(t)\sin wt\, dt$.

iv) The value of the unity impulse function $\delta(t)$ at $t = 0$ is

a) 0 b) $\bullet$

c) 1 d) indeterminate.

v) The number of links for a graph having n nodes and b branches is

a) $b - n + 1$ b) $n - b + 1$

c) $b + n - 1$ d) $b + n$.

vi) The h parameters h_{11} and h_{12} are obtained by

a) shorting output terminals

b) opening input terminals

c) shorting input terminals

d) opening output terminals.

vii) The convolution of $f(t) * g(t)$ is

a) $\int_0^{\bullet} f(t)\, g(t-\tau)\, d\tau$ b) $\int_0^{t} f(\tau)\, g(t-\tau)\, d\tau$

c) $\int_0^{t} f(t-\tau)\, g(t)\, dt$ d) $\int_0^{t} f(t)\, g(t-\tau)\, dt$.

viii) A ramp voltage $V(t) = 100$ V is applied to an RC series circuit with $R = 5$ kΩ and C = 4 μF. The maximum output voltage across capacitor is

a) 0·2 volt b) 2·0 volt

c) 10·0 volt d) 50·0 volt.

ix) Relative to a given fixed tree of a network

a) link currents form an independent set

b) branch currents form an independent set

c) branch voltages form an independent set

d) both (a) and (c).

x) The maximum power transfer occurs at an efficiency of

a) 100% b) 50%

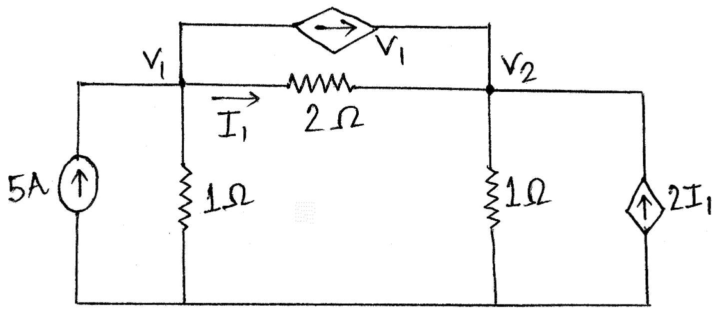
c) 75% d) 25%.

GROUP – B

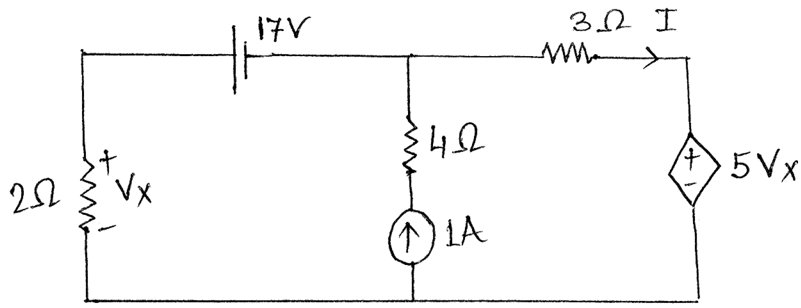
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

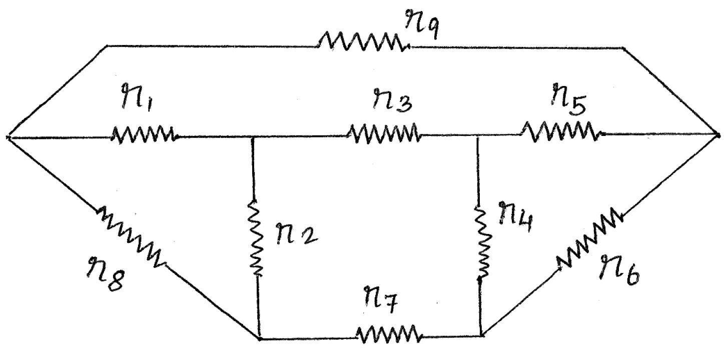
2. For the circuit shown in the figure, find the node voltages V_1 and V_2.



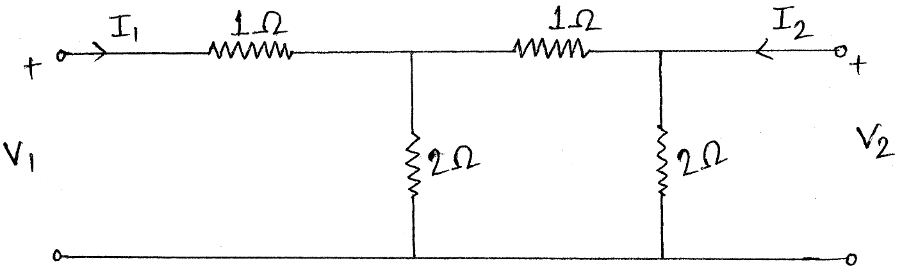
3. Find current I in the circuit using superposition theorem.



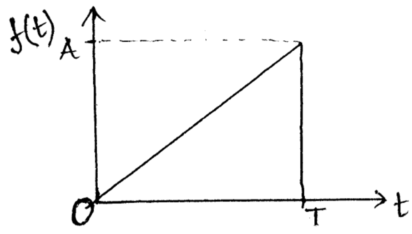
4. For the network shown in the figure, draw the oriented graph and write the incidence matrix, tie-set matrix.



5. Obtain the ABCD parameters for the network shown in the figure.



6. Derive the Laplace transform for the waveform shown in the figure.



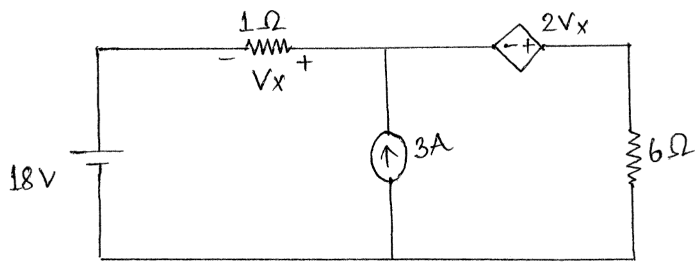
7. Find the inverse Laplace transform of $\dfrac{1}{s(s^2 - \theta^2)}$

GROUP – C

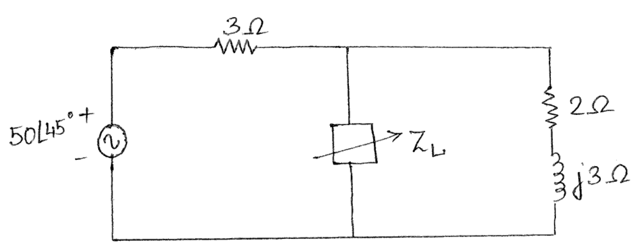
(Long Answer Type Questions)

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

8. a) Find the current in the 6 Ω resistor using Thevenin's theorem : 7

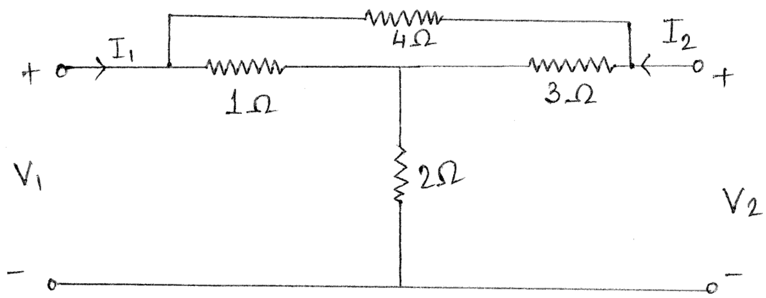


b) Find the load impedance Z_L to transfer maximum power in the circuit shown. Find also the value of maximum power consumed by the load. 8



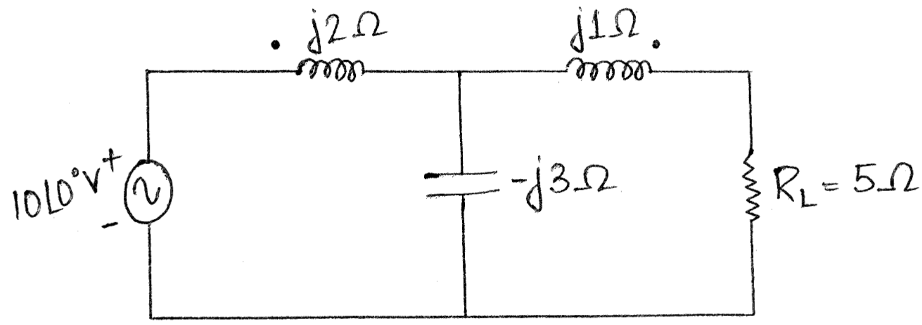
9. a) Express Z parameters in terms of Y and ABCD parameters. 8

b) Find the Z parameters for the network shown below : 7



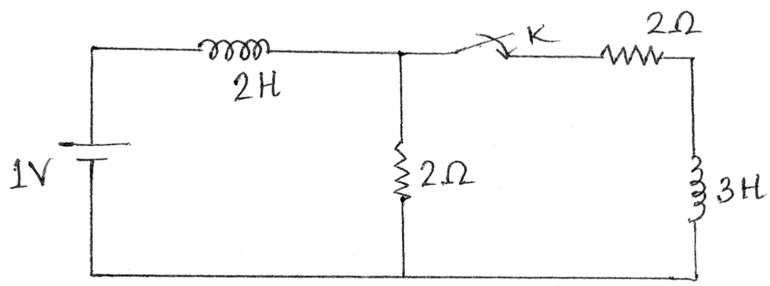
10. a) Two coupled coils have self inductances L_1 = 10 mH, L_2 = 20 mH. The coefficient of coupling (k) being 0·75 in air. Find the voltage in the second coil and the flux of the first coil provided the second coil has 500 turns and the circuit current is given by $i_1 = 2 \sin 314t$. 6

b) Find the drop across R_L. 9



11. a) State and prove the final value theorem. 5

b) In the network shown below the switch is closed at $t = 0$, the steady state being reached before $t = 0$. Determine current through inductor 3 H. 10



12. a) Obtain the current expression when an impulse response is applied to a series R–C circuit at $t = 0$. 5

b) In an RLC series circuit $R = 10\ \Omega$, $L = 100$ mH, $C = 10\ \mu$F. Calculate ω_0, ω_1, ω_2. Also find bandwidth, quality factor and selectivity. 5

c) Draw a first order LPF filter and obtain the ratio $\frac{v_0}{v_1}$. 5