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 : $10 \times 1 = 10$

i) Maximum power transfer occurs at circuit efficiency of

a) 100% b) 50%

c) 25% d) 75%.

ii) The internal impedance of an ideal voltage source should be

a) zero

b) infinite

c) greater than zero but less than infinity

d) none of these.

iii) A step function is the first derivative of

a) ramp function

b) parabolic function

c) gate function

d) impulse function.

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

a) linear b) nonlinear

c) parabolic d) none of these.

v) In a Thevenin's equivalent circuit V_{TH} = 30V and R_{TH}= 6 Ω $TH\,R$, then the current flowing through load resistance R_L is

a) 5A b) more than 5 A

c) less than 5A d) none of these.

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

a) 0 b) 1

c) infinite d) intermediate.

vii) In series R-L-C circuit at resonance condition power factor is

a) 0 b) 1

c) 0·8 leading d) 0·8 lagging.

viii) A 1 μF capacitor is connected across a 4 V battery, steady state current will be

a) 4×10^{-6} Amp b) $10^6/4$ Amp

c) zero d) 4 Amp.

ix) For n number of nodes and b number of branches the rank of graph is

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

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

x) Norton's theorem is valid for a network containing only

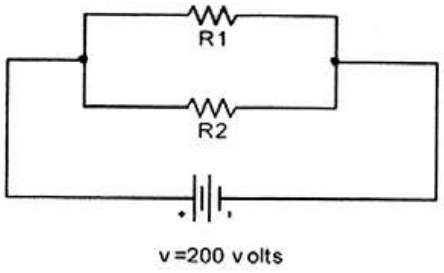
a) linear elements b) non-linear elements

c) resistances d) reactive elements.

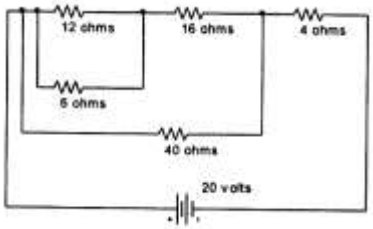
GROUP – B
(Short Answer Type Questions)

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

2. Two resistors are connected in parallel and a voltage of 200 volts is applied to the terminals. The total current taken is 25 A and the power dissipated in one of the resistors is 1500 Watts. What is the resistance of each element?



3. Calculate the equivalent resistance of the following Combination of resistor and source current .



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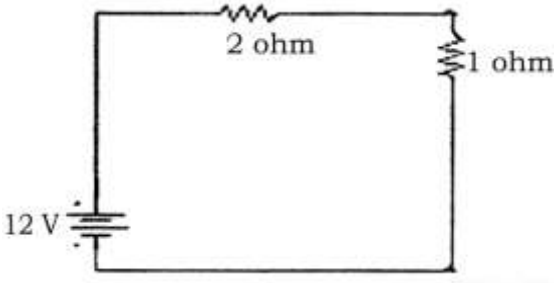
4. For the network shown in the following figure convert the voltage source into current source.



5. Draw the frequency response of R-L circuit and explain. In a parallel RL circuit R = 3 ohm and $_L X$ = 4 ohm. What is the value of admittance ?

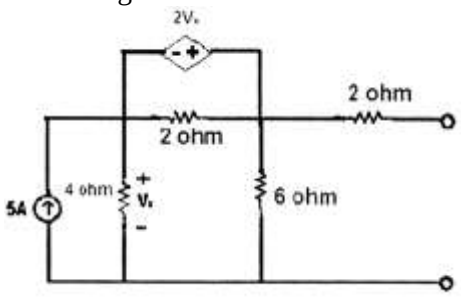
6. Define Laplace transform. Write two properties of Laplace transformations.

GROUP – C
(Long Answer Type Questions)

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

7. a) State and prove Maximum power transfer theorem.

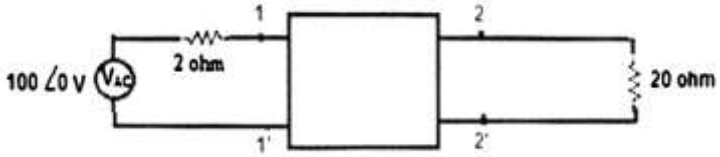
b) Find Thevenin equivalent resistance, Open circuit voltage and also draw Thevenin equivalent circuit for the following network.



5 + 10

8. a) Find interrelationship between *h*-parameter and *Z-parameter*.

b) The *h* parameters of a two port network shown in Following figure are h_{11}= 1 kΩ, h_{12}= 0·003, h_{21} = 100, h_{22}=500 μmho. Find V_2 and *z* parameters of the Network.

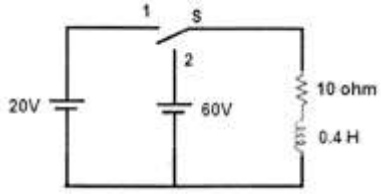


5 + 10

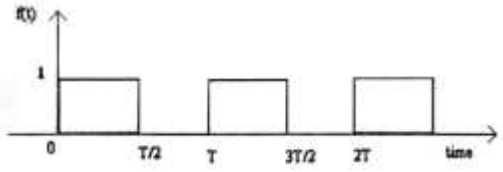
9. a) Find the inverse Laplace of *F* (*s*).

F (s) = $\frac{s+1}{s(s2+4s+s)}$

b) The circuit was in steady state with switch in position 1. Find current *i* (*t*) for *t* > 0 if the switch is moved from position 1 to 2 at *t* = 0.

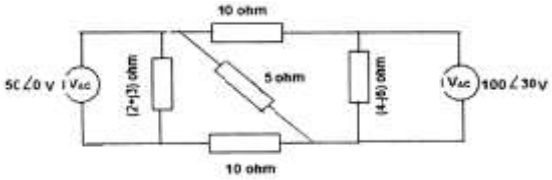


c) Determine the Laplace transform of the periodic square pulse train of amplitude as shown in following figure :

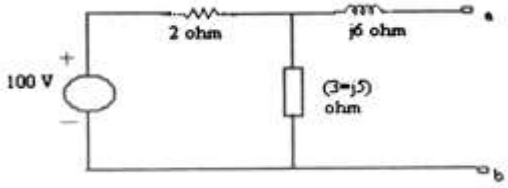


5 + 5 + 5

10. a) Find current through 5 ohm resistor using superposition theorem.



b) In the following circuit what should be the value of impedance connected between *a* and *b* for maximum power to be transferred from the source.



10 + 5

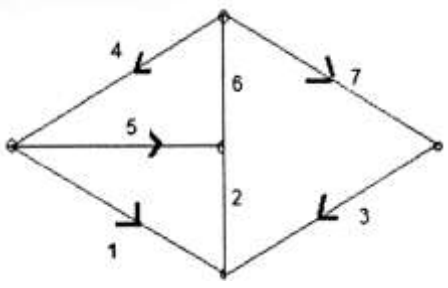
11. a) Find the resonance frequency for practical parallel R-L-C circuit.

b) A 125 volt ac source supplies a series circuit consisting of a 20·5 μF capacitor and a coil with resistance and inductance 1·06 ohm and 25·4 mH. The source frequency adjusted so as to bring the circuit to resonance.

i) Determine source frequency and current supplied by the source.

ii) Voltage across capacitor and the coil.

c) Develop the tie-set matrix for the graph shown in following figure.



5 + 5 + 5

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