

Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(ECE-N)/SEM-3/EC-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 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.

3104(N)

[Turn over

CS/B.TECH(ECE-N)/SEM-3/EC-301/2012-13



- iii) A step function is the first derivative of
- ramp function
 - parabolic function
 - gate function
 - impulse function.
- iv) The equation $Y = mx + c$ is
- linear
 - nonlinear
 - parabolic
 - none of these.
- v) In a Thevenin's equivalent circuit $V_{TH} = 30 \text{ V}$ and $R_{TH} = 6 \Omega$, then the current flowing through load resistance R_L is
- 5 A
 - more than 5 A
 - less than 5 A
 - none of these.
- vi) The value of unity impulse function $\delta(t)$ at $t = 0$ is
- 0
 - 1
 - infinite
 - intermediate.
- vii) In series R-L-C circuit at resonance condition power factor is
- 0
 - 1
 - 0.8 leading
 - 0.8 lagging.
- viii) A $1 \mu\text{F}$ capacitor is connected across a 4 V battery, steady state current will be
- $4 \times 10^{-6} \text{ Amp}$
 - $10^6 / 4 \text{ Amp}$
 - zero
 - 4 Amp.

CS/B.TECH(ECE-N)/SEM-3/EC-301/2012-13



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

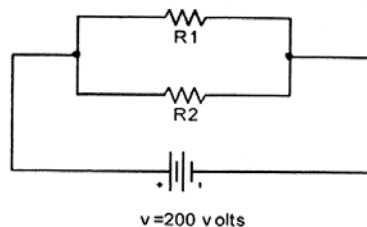
- a) linear elements b) non-linear elements
 c) resistances d) reactive elements.

GROUP - B

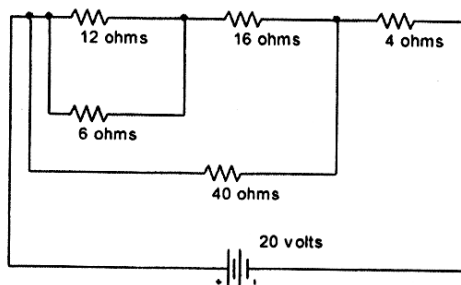
(Short Answer Type Questions)

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 ?



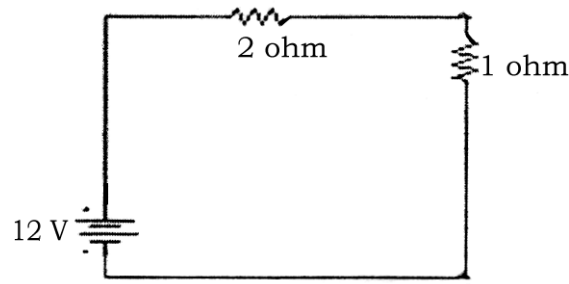
3. Calculate the equivalent resistance of the following combination of resistor and source current.



CS/B.TECH(ECE-N)/SEM-3/EC-301/2012-13



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



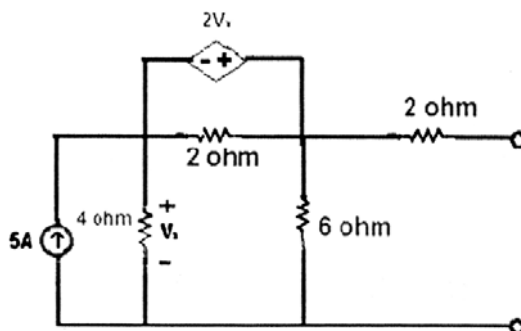
5. Draw the frequency response of R-L circuit and explain. In a parallel RL circuit $R = 3 \text{ ohm}$ and $X_L = 4 \text{ ohm}$. What is the value of admittance ?
6. Define Laplace transform. Write two properties of Laplace transformations.

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

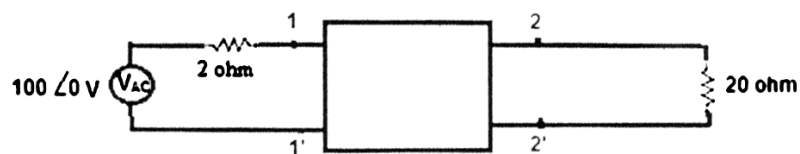
3104(N)

4

CS/B.TECH(ECE-N)/SEM-3/EC-301/2012-13



8. a) Find interrelationship between h -parameter and z -parameter.
- b) The h parameters of a two port network shown in following figure are $h_{11} = 1 \text{ k}\Omega$, $h_{12} = 0.003$, $h_{21} = 100$, $h_{22} = 500 \text{ }\mu\text{mho}$. Find V_2 and z parameters of the network.

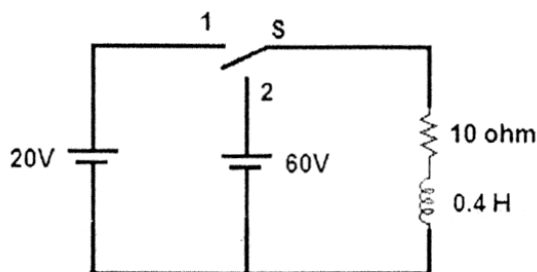


5 + 10

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

$$F(s) = \frac{s+1}{s(s^2 + 4s + 4)}$$

- 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 $t = 0$.

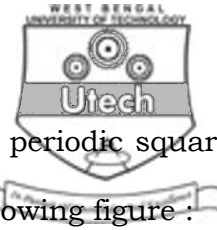


3104(N)

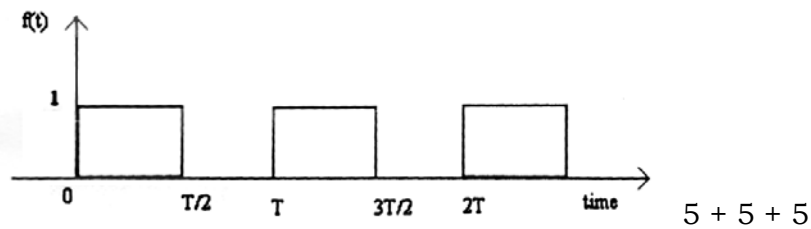
5

[Turn over

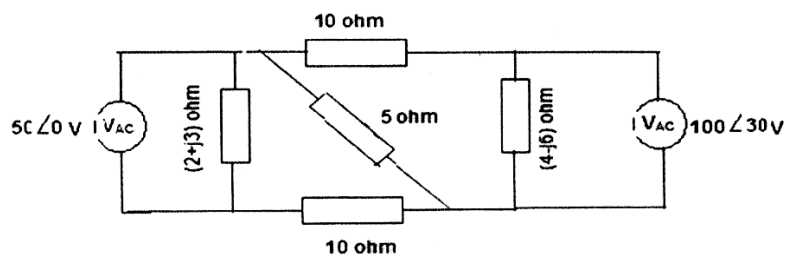
CS/B.TECH(ECE-N)/SEM-3/EC-301/2012-13



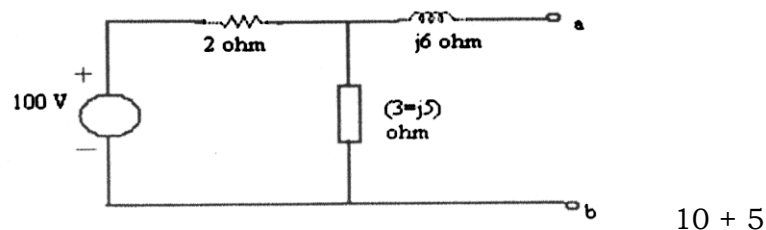
- c) Determine the Laplace transform of the periodic square pulse train of amplitude as shown in following figure :



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.



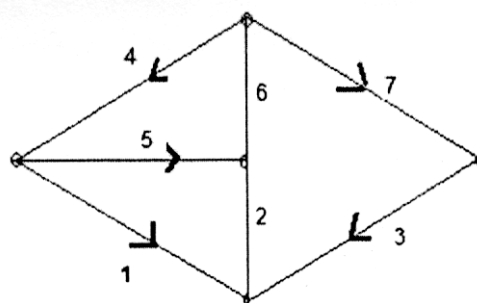
3104(N)

6

CS/B.TECH(ECE-N)/SEM-3/EC-301/2012-13



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 $20.5 \mu\text{F}$ 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.
- Determine source frequency and current supplied by the source.
 - Voltage across capacitor and the coil.
- c) Develop the tie-set matrix for the graph shown in following figure.



5 + 5 + 5

=====