Total number of printed pages–7

53 (IE 301) NWTH

2021

NETWORK THEORY

Paper : IE 301

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Define the following terms : 5

   (i) Mesh

   (ii) Node

   (iii) Ideal voltage source

   (iv) Passive Network

   (v) Lumped Network.

   (b) Differentiate between : 2+2=4

   (i) Time invariant and time variant sources

Contd.

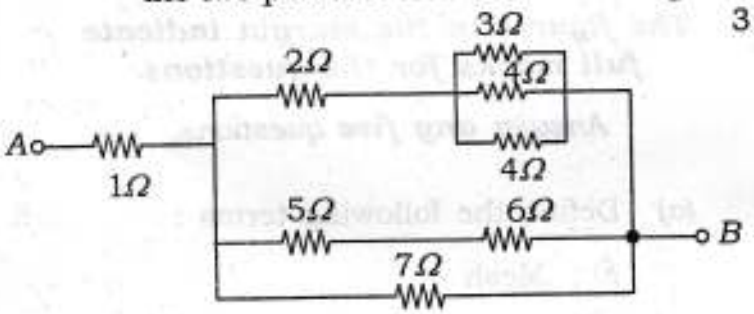
(ii) Unilateral and bilateral networks.

(c) Explain with a suitable example how to obtain — 4+4=8

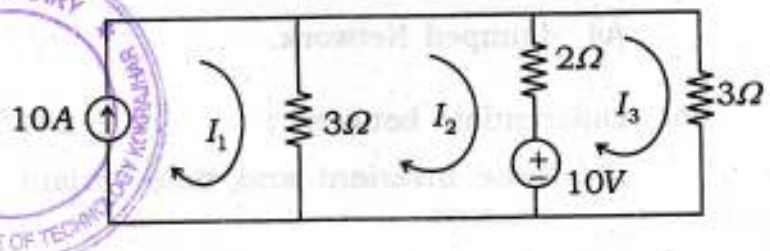
(i) an equivalent current source from a given voltage source

(ii) loop analysis of analysing a given network.

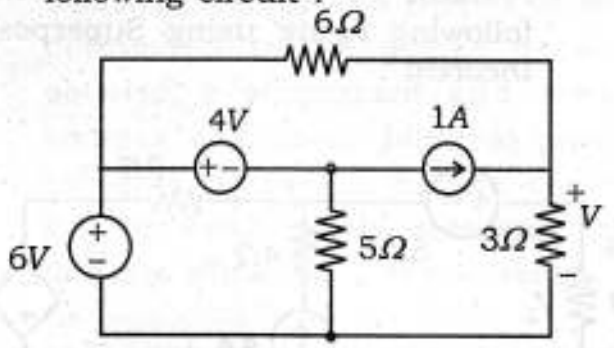
(d) Find the equivalent resistance between the two points A and B shown in figure : 3



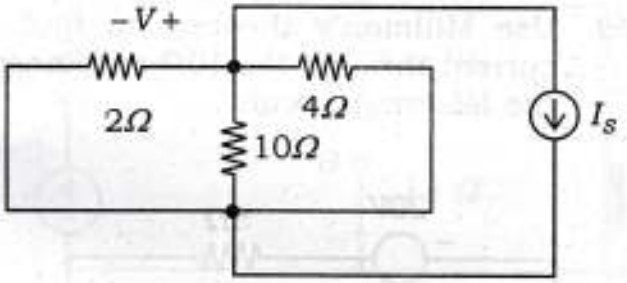
2. (a) Write the mesh equation for the circuit shown and determine mesh currents using mesh analysis. 10



(b) Find the value of voltage V in the following circuit : 6



(c) In the following circuit if $V = 10V$, then find value of I_5 4

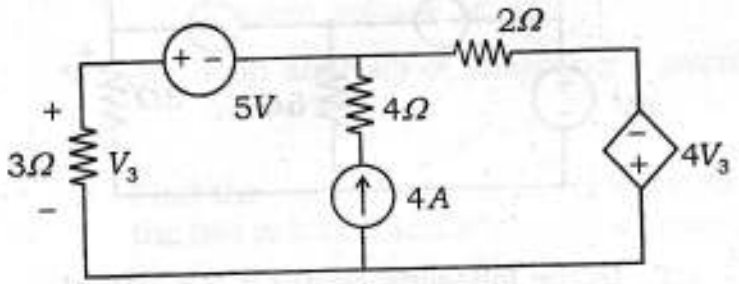


3. (a) State and explain the following theorem : 5+5=10

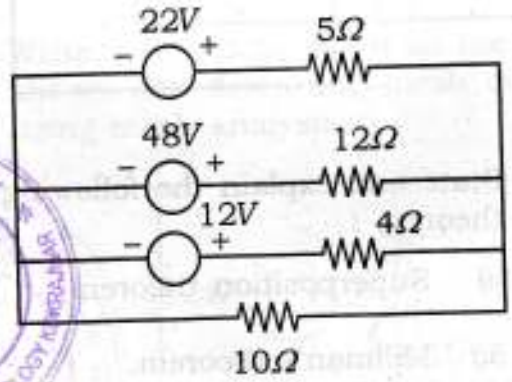
(i) Superposition theorem

(ii) Millman's theorem.

(b) Determine the current through 2Ω resistor of the network shown in following figure using Superposition theorem : 7

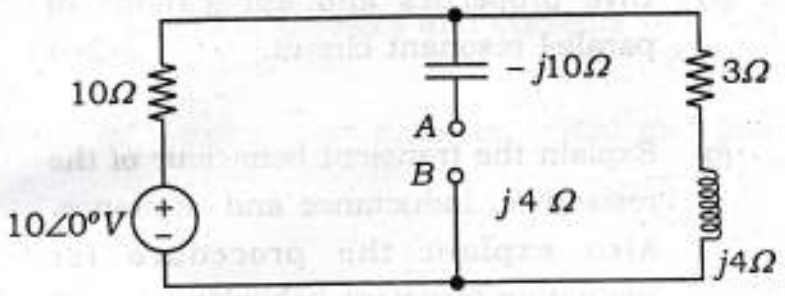


(c) Use Millman's theorem to find the current through the 10Ω resistance in the following circuit : 3



4. *(a)* State and prove the maximum power transfer theorem for a passive network connected to an active network consisting of current and voltage sources and linear bilateral passive elements, when the passive network load consists a variable resistance. Also find the efficiency of transmission. 10

(b) Replace the network at terminals *AB* with Norton's and Thevenin's equivalent circuit. 10



5. *(a)* Define quality factor and bandwidth. Also establish the relationship between them in a series resonance circuit. 10

(b) A series RLC circuit consists of a resistance $1k\Omega$ and an inductance of $120mH$ is series with capacitance of $12pF$. If $120V$ is applied as input across the combination, determine : 6

(i) The resonant frequency

(ii) Maximum current in the circuit

(iii) Q-factor

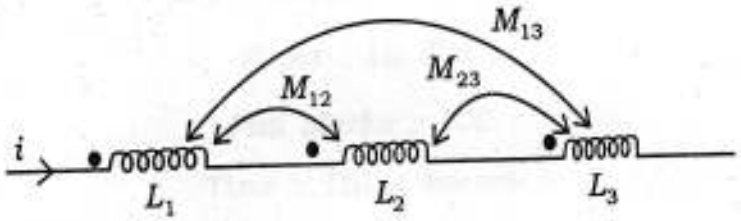
(iv) Half frequencies.

(c) Give properties and applications of parallel resonant circuit. 2+2=4

6. (a) Explain the transient behaviour of the resistance, inductance and capitance. Also explain the procedure for evaluating transient behaviour. 10

(b) Find the expression for the current in a series RLC circuit fed by a d.c. voltage of $20V$ with $R=4\Omega$, $L=1H$ and $C=\frac{1}{4}F$. Assume initial conditions to be zero. 10

7. *(a)* Find the total inductance of the three series connected coupled coils in the given *figure* if $L_1 = 1H$, $L_2 = 2H$, $L_3 = 5H$; $M_{12} = 0{\cdot}5\,H$, $M_{23} = 1H$ and $M_{13} = 1H$. 6



(b) Give advantages of three phase system. Derive relationship between line and phase voltages and currents in a star connection. 3+7=10

(c) Write short notes on initial and final value theorem. 4