Total number of printed pages–7

53 (IE 301) NWTH

2018

NETWORK THEORY

Paper : IE 301

Full Marks : 100

Time : Three hours

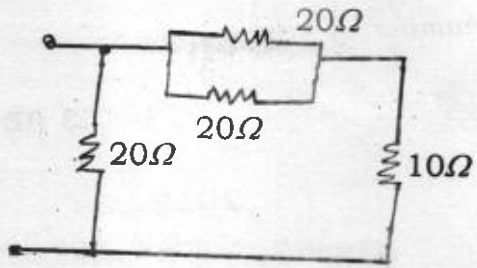
The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What are the active elements and passive elements ? A 4·0 Ω resistor has a current $i = 2{\cdot}5 \sin \omega t$. Find the voltage, power and energy over one cycle. $\omega = 500$ *rad/s*. 2+6=8

Contd.

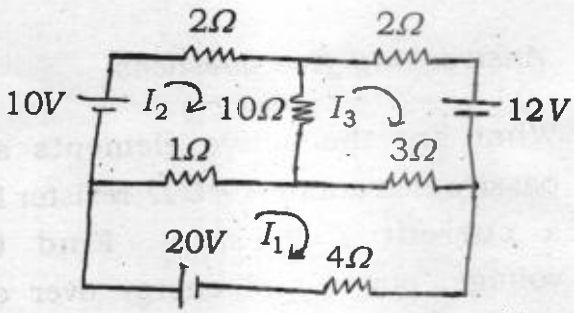
(b)



Find the equivalent resistance of the circuit. 5

(c) How a voltage source can be converted into current source and current source can be converted into voltage source ? 7

2. (a)



Find the current through 1Ω resistor. 10

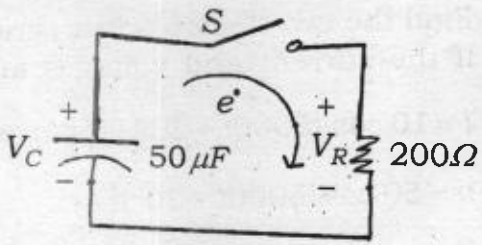
(b) Obtain the response of an RL circuit to the following inputs.

(i) Unit impulse

(ii) Unit step

(iii) Unit ramp 3+3+4=10

3. (a)



At $t = 0_-$, just before the switch S is turned on, $V_C = 50V$. Obtain the current and charge transients. 5

(b) A series RLC circuit with $R = 100\Omega$, $L = 0{\cdot}1H$, $C = 10\mu F$, has an initial change on the capacitor of $Q_0 = 2{\cdot}67 \times 10^{-3}C$. A switch is closed at $t = 0$, allowing the capacitor to discharge. Obtain the current transient. 10

(c) Define the terms — driving point impedance and transfer impedance. 5

4. (a) If $V_1 = 25{\cdot}0 < 143{\cdot}13°$ and $V_2 = 11{\cdot}2 < 26{\cdot}57°$, find the ratio V_1 / V_2 and the sum $V_1 + V_2$. 5

(b) Find the two elements in a series circuit if the current and voltages are

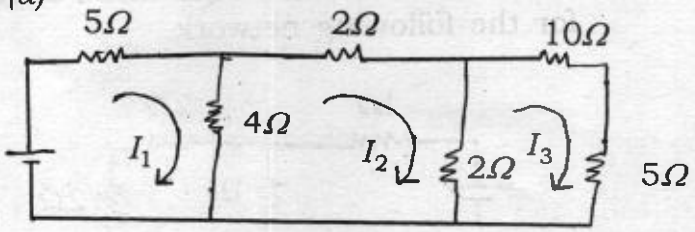
$i = 10 \cos (5000t - 23{\cdot}13°)(A)$ and

$v = 50 \cos (5000t + 30°)(A)$ 5

(c) Find P delivered from a sinusoidal voltage source with $v_{eff} = 110\,V$ to an impedance of $z = 10 + j8$. Find the power factor. 5

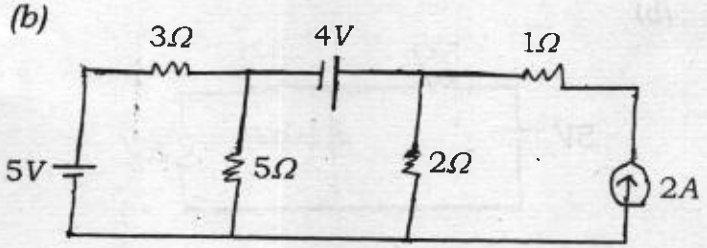
(d) A certain passive network has equivalent impedance $z = 3 + j4R$ and $v = 42 \cos (2000t + 20°)$. Find P and Q. 5

5. *(a)*



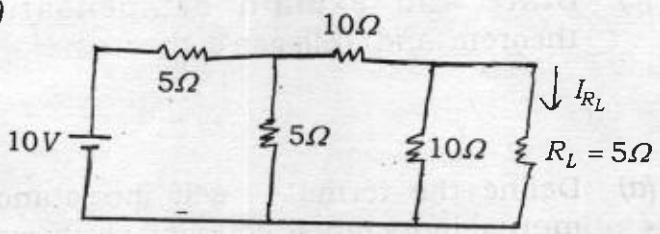
Obtain the current I_1, I_2, I_3 using mesh analysis. 7

(b)



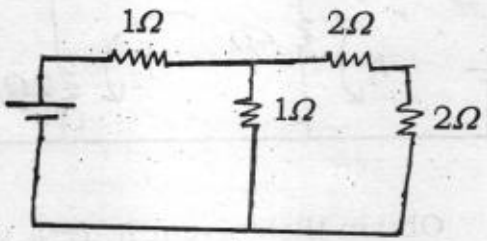
Find the current through the 1Ω resistor using superposition theorem. 7

(c)

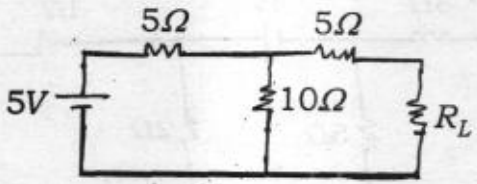


Using Thèvenin's theorem obtain the current I_{RL}. 6

6. *(a)* Obtain the Norton's equivalent circuit for the following network. 5



(b)



Obtain value of R_L for maximum power transfer. 5

(c) State and explain compensation theorem and Tellegen's theorem. 10

7. *(a)* Define the terms — self inductance, mutual inductance, coupling coefficient. 6

(b) When one coil of a magnetically coupled pair has a current $5{\cdot}0\,A$, the resulting fluxes ϕ_{11} and ϕ_{12} are $0{\cdot}2\,mWb$ and $0{\cdot}4\,mWb$ respectively. If the turns are $N_1 = 500$ and $N_2 = 1500$, find L_1, L_2, M and the coefficient of coupling.

8

(c) What are the advantages of three phase system over single phase system.

6