53 (IE 301) NWTH

2014

NETWORK THEORY

Paper : IE 301

Full Marks : 100

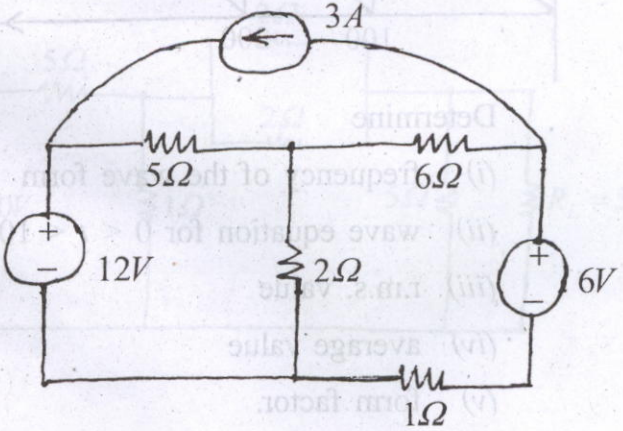
Pass Marks : 30

Time : Three hours

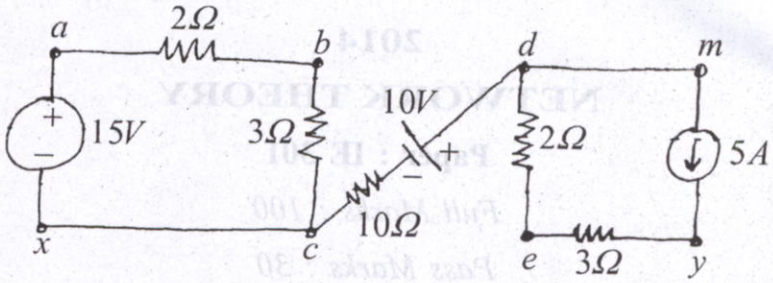
The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions.*

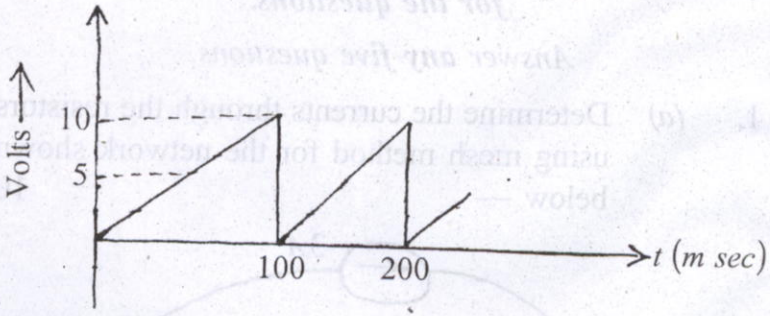
1. *(a)* Determine the currents through the resistors using mesh method for the network shown below — 10



(b) Find voltage drop between terminals a and e for the following network. 5



(c) A periodic voltage waveform has been shown below — 5



Determine

(i) frequency of the wave form

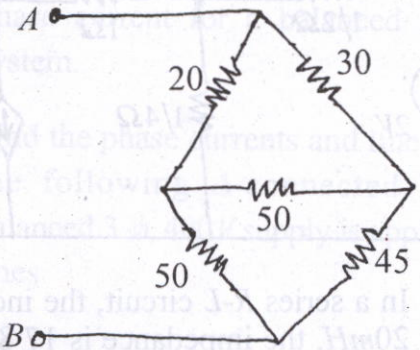
(ii) wave equation for $0 < t < 100m\ sec$

(iii) r.m.s. value

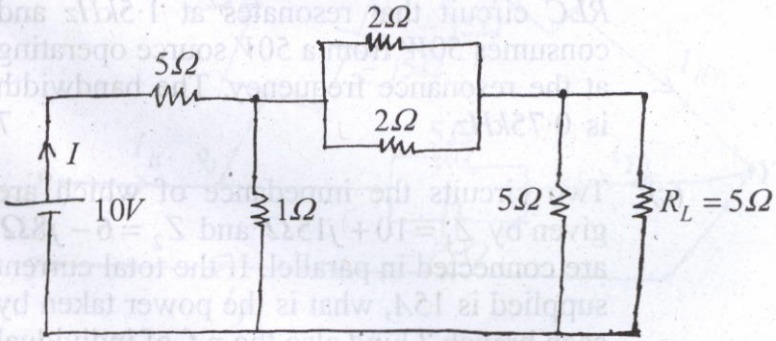
(iv) average value

(v) form factor.

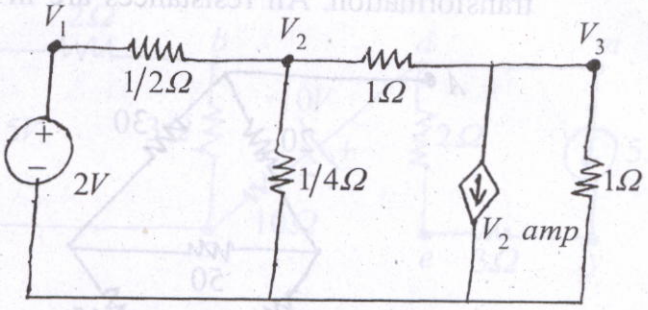
2. *(a)* Find the resistance at the *A-B* terminals in the electric circuit using delta-star transformation. All resistances are in *ohm*. 6



(b) In the circuit shown below, find I and voltage drop across R_L. 7



(c) In the network given below, find V_1, V_2 and V_3 by nodal analysis. 7



3. (a) In a series *R-L* circuit, the inductance being $20mH$, the impedance is $17{\cdot}85\Omega$. The angle of lag of the input current from the applied voltage being $63{\cdot}5°$, find the values of angular frequency and the resistance of the circuit. 6

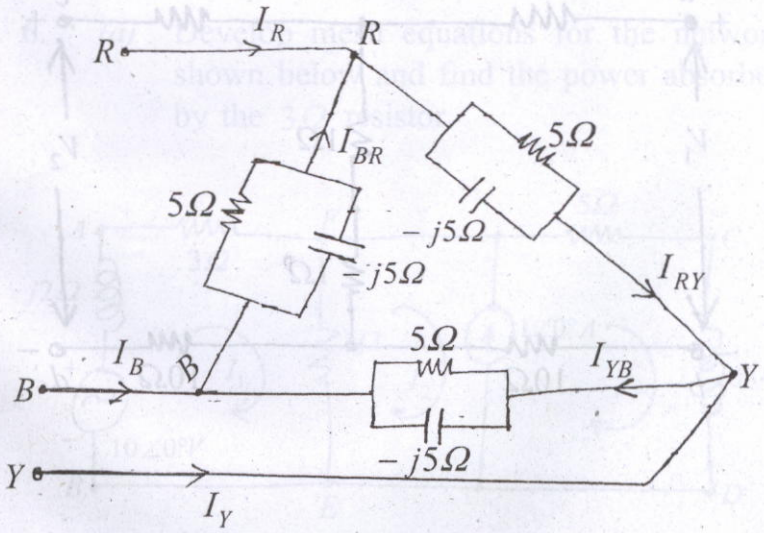
(b) Obtain the values of R, L and C in a series RLC circuit that resonates at $1{\cdot}5kHz$ and consumes $50W$ from a $50V$ source operating at the resonance frequency. The bandwidth is $0{\cdot}75kHz$. 7

(c) Two circuits the impedance of which are given by $Z_1 = 10 + j15\Omega$ and $Z_2 = 6 - j8\Omega$ are connected in parallel. If the total current supplied is $15A$, what is the power taken by each branch ? Find also the *p.f.* of individual circuits and of the combination. Also draw the vector diagram. 7

4. *(a)* Write *three* advantages of 3-ϕ system over 1-ϕ system. 3

(b) Derive a relation between line current and phase current for a balanced Δ-connected system. 5

(c) Find the phase currents and line currents for the following Δ-connected loads, if a balanced 3-ϕ, $400V$ supply is applied between lines 12

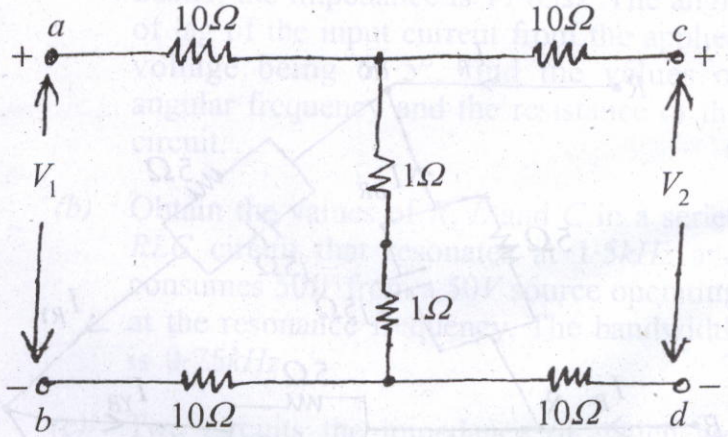


5. *(a)* Define the following :

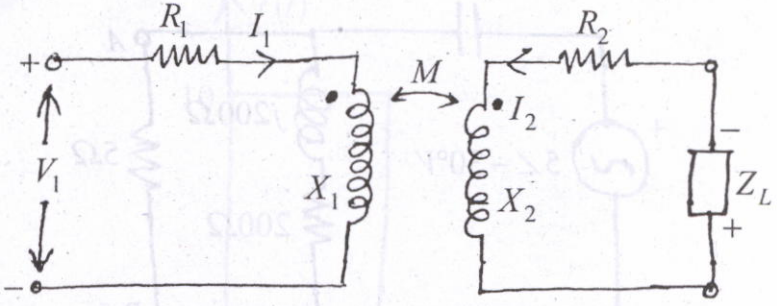
(i) Unilateral and bilateral circuits

(ii) Linear and non-linear elements. 2+2=4

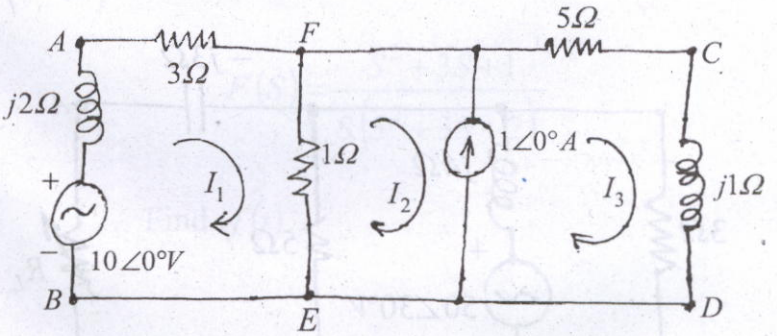
(b) Determine the Z-Parameters for the following network — 9



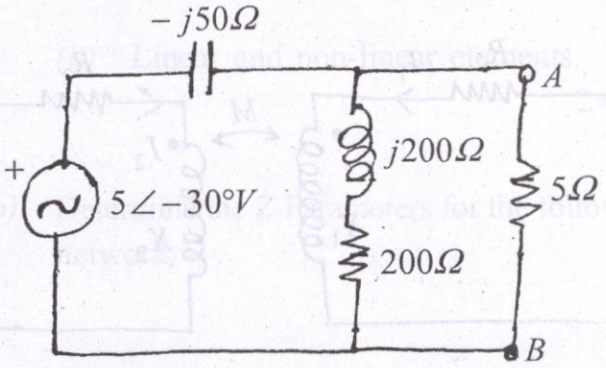
(c) For an ideal transformer, shown below, find the input impedance. Assume load impedance to be Z_L 7



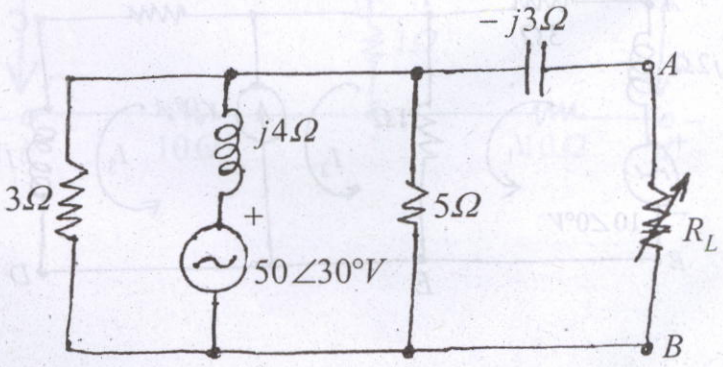
6. (a) Develop mesh equations for the network shown below and find the power absorbed by the 3Ω resistor 7



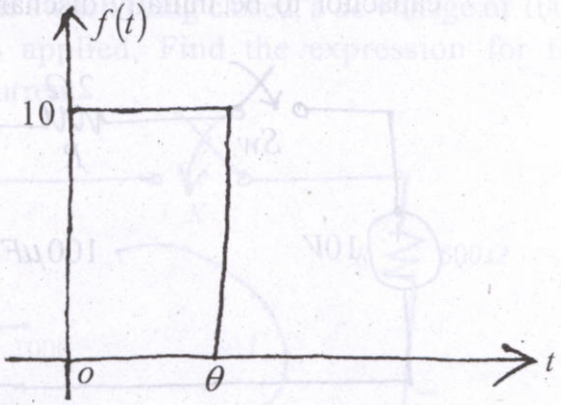
(b) In the network given below, calculate current in the 5Ω resistor using Thevenin's theorem 6



(c) What should be the value of R_L so that maximum power can be transferred from the source to load in the circuit given below ? 7



7. *(a)* A pulse waveform is shown below. Obtain its Laplace transform 5

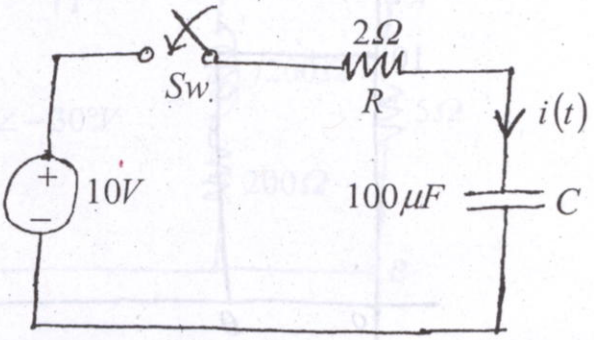


(b) Function in *S*-domain is given by — 5

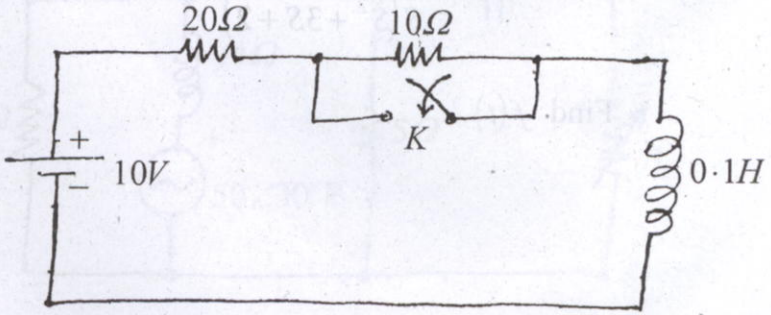
$$F(S)=\frac{S^2+3S+1}{S\left(S^2+3S+2\right)}$$

Find $f(t)$.

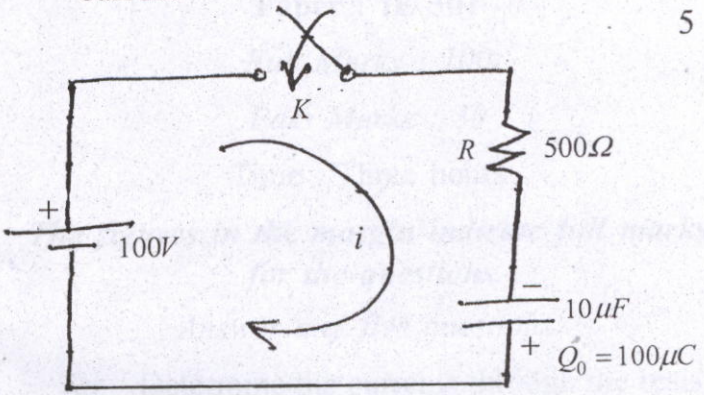
(c) For the circuit shown below, obtain the current through the capacitor C at $t = 0+$ following switching at $t = 0$. Assume the capacitor to be initially discharged 10



8. (a) A dc voltage of $100V$ is applied in the following circuit and the switch K is open. The switch K is closed at $t = 0$. Find the complete expression for the current 8



(b) The $10\mu F$ capacitor in RC circuit shown below has initial charge of $100\mu C$ with polarities as shown in the fig. below At $t = 0$, the switch being closed, a dc voltage of $100V$ is applied. Find the expression for the current. 5



(c) What do you mean by lagging and leading power factor ? Draw a phasor diagram of RLC series circuit with sinusoidal excitation. If this circuit is in resonance, what will be the impedance and power factor of the circuit ? 1+1+3+2=7