53 (IE 301) NWTH

2014

NETWORK THEORY

Paper : IE 301

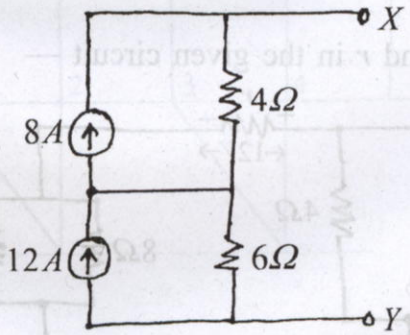
Full Marks : 100

Time : Three hours

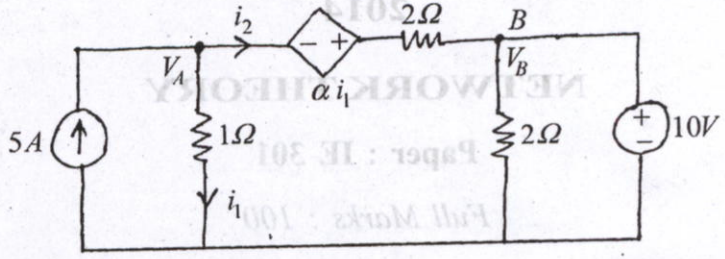
The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

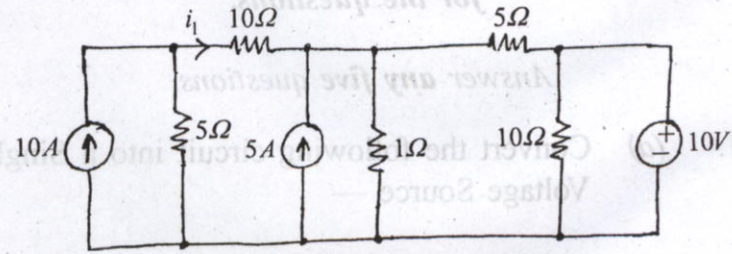
1. *(a)* Convert the following circuit into a Single Voltage Source — 4



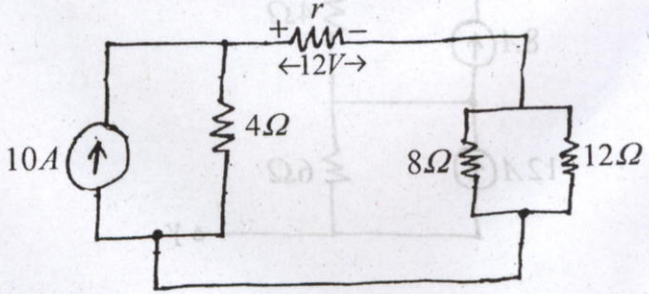
(b) Using Nodal Analysis, find the value of α in the given circuit when the power loss in the 1Ω resistor is $9W$. 6



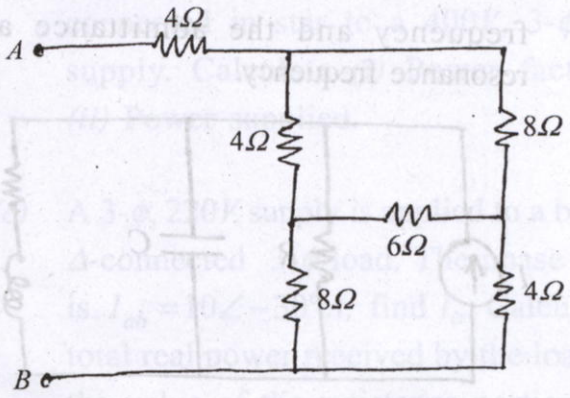
(c) Obtain the current i_1 in the following circuit using KVL. 10



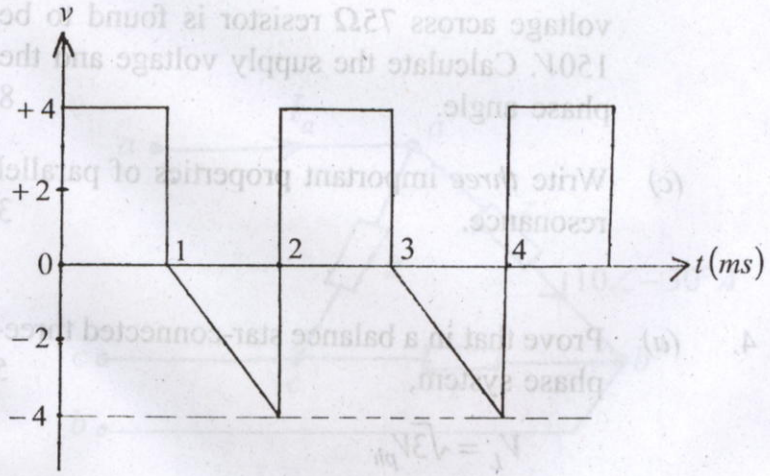
2. (a) Find r in the given circuit — 8



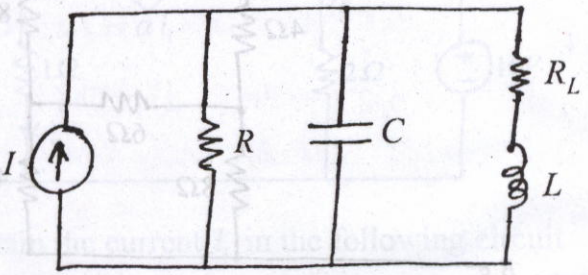
(b) Find the equivalent resistance between points A and B of the following circuit — 5



(c) Calculate the RMS and average value of the voltage wave given below — 7



3. *(a)* In the circuit shown below, $R = R_L = 1\Omega$, $L = 1H, C = 0 \cdot 5F$. Find the resonance frequency and the admittance at the resonance frequency. 9



(b) A pure inductance of $318mH$ is connected in series with a pure resistance of 75Ω. The circuit is supplied from $50Hz$ source and the voltage across 75Ω resistor is found to be $150V$. Calculate the supply voltage and the phase angle. 8

(c) Write *three* important properties of parallel resonance. 3

4. *(a)* Prove that in a balance star-connected three-phase system, 5

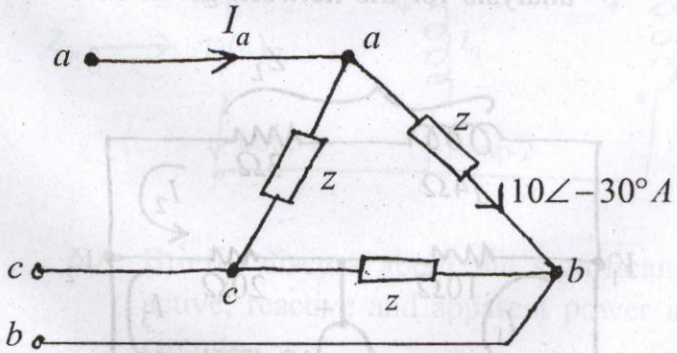
$$V_L = \sqrt{3} V_{ph}$$

where V_L = line voltage, V_{ph} = phase voltage.

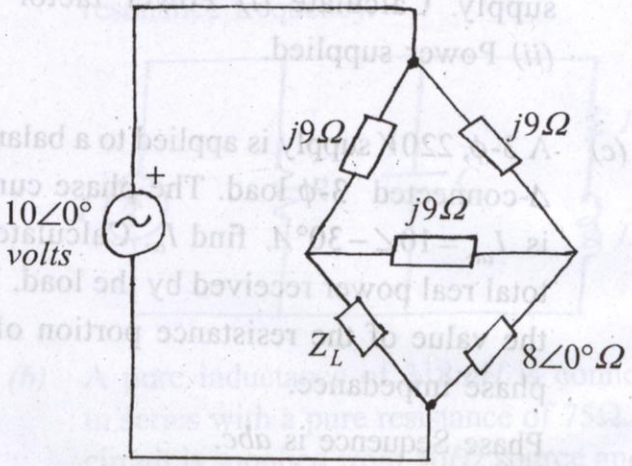
(b) Three coils, each having a resistance of 20Ω and inductive reactance of 15Ω are connected in star to a $400V$, 3-ϕ, $50Hz$ supply. Calculate *(i)* Power factor and *(ii)* Power supplied. 6

(c) A 3-ϕ, $220V$ supply is applied to a balanced Δ-connected 3-ϕ load. The phase current is $I_{ab} = 10\angle -30°A$, find I_a. Calculate the total real power received by the load. Find the value of the resistance portion of the phase impedance.

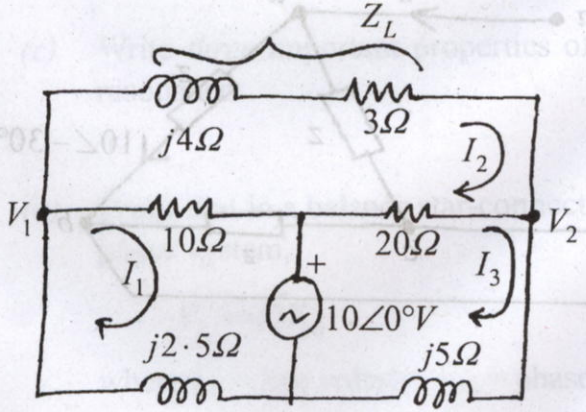
Phase Sequence is *abc*. 9



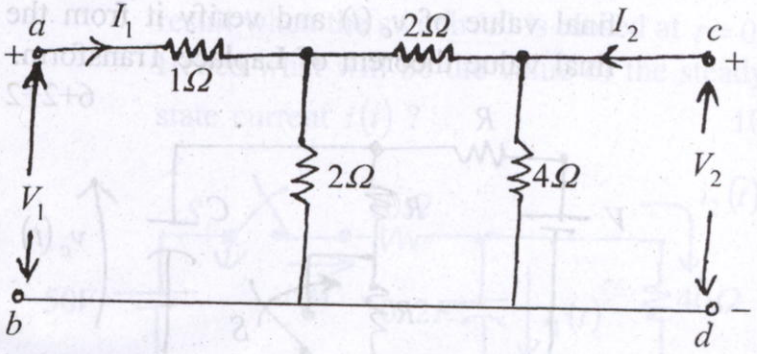
5. *(a)* Find the value of Z_L to have maximum power transfer from the $10\angle 0°$ voltage source. Also determine the amount of maximum power. 10



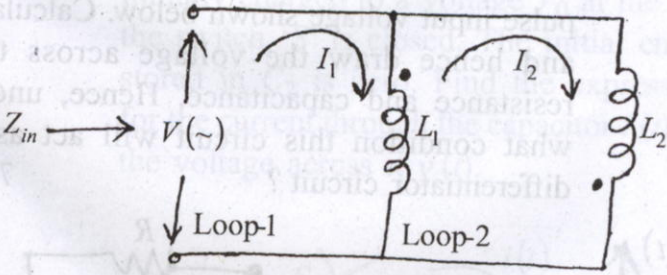
(b) Find the current through Z_L using mesh analysis for the network given below — 10



6. *(a)* Find the *Y*-Parameters for the Network given below — 8

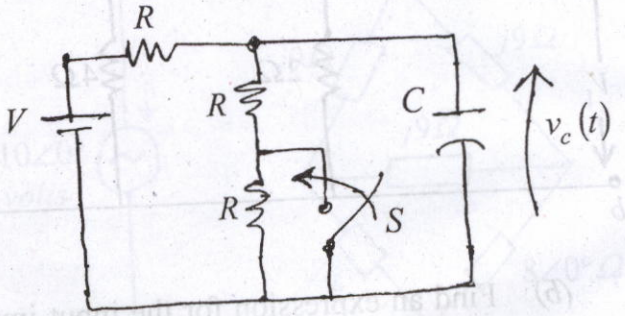


(b) Find an expression for the input impedance of the following circuit — 7

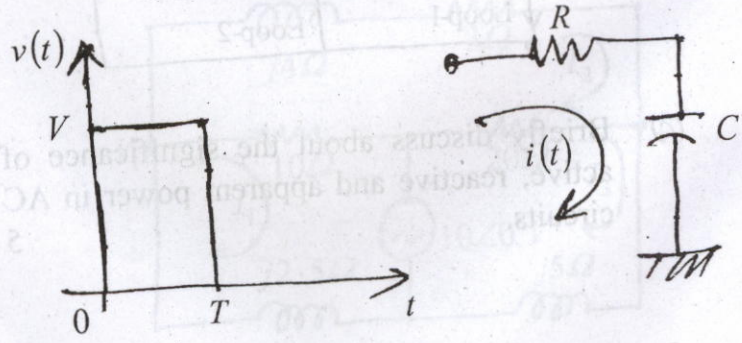


(c) Briefly discuss about the significance of active, reactive and apparent power in AC circuits. 5

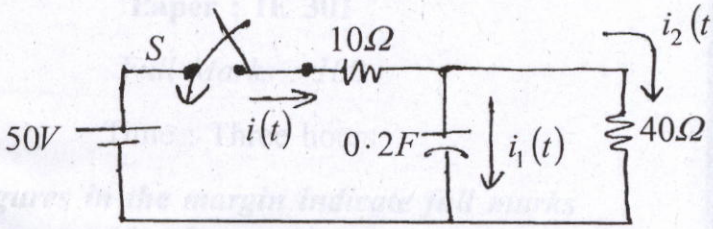
7. *(i)* The circuit shown in the figure below is initially in the steady state. The switch '*S*' is closed at t = 0. *(a)* Find $v_c(t)$ *(b)* Find the final value of $v_c(t)$ and verify it from the final value theorem of Laplace Transform. 6+2+2



(ii) Consider a series *RC* circuit subjected to a pulse input voltage shown below. Calculate and hence draw the voltage across the resistance and capacitance. Hence, under what condition this circuit will act as a differentiator circuit ? 7+3



8. *(i)* In the two-mesh network shown in the figure below, the capacity is uncharged. Find the loop currents $i_1(t)$ and $i_2(t)$ which will result when the switch 'S' is closed at $t = 0$. Hence what will be the value of the steady state current $i(t)$? 10



(ii) In the given circuit, the capacitor 'C_1' is initially charged to a voltage V_0 at the time the switch 'S' is closed. The initial energy stored in C_2 is zero. Find the expressions for the current through the capacitor $i(t)$ and the voltage across it $v(t)$. 5+5