Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/EIE (O)/SEM-3/EE-301(EI)/2012-13

2012

CIRCUIT THEORY & 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) A four terminal network constitutes a

      a) one-port network b) two-port network

      c) four-port network d) none of these.

   ii) A capacitor C at time $t = 0+$ with zero initial charge acts as a

      a) short circuit b) open circuit

      c) current source d) voltage source.

   iii) Kirchhoff's law fails in case of

      a) Linear networks

      b) Non-linear networks

      c) Dual networks

      d) Distributed parameter networks.

iv) It is given that $Z_1 = (2 + j\ 3)\ \Omega$ & $Z_2 = (6 + j\ 3)\ \Omega$, Then $| Z_1 + Z_2 |$ is

a) 10 Ω b) 14 Ω

c) 11 Ω d) none of these.

v) The phasor combination of resistive power & reactive power is called

a) true power b) apparent power

c) reactor power d) average power.

vi) The node method of circuit analysis is based on

a) KVL & ohm's law

b) KCL & KVL

c) KCL, KVL & Ohm's law

d) KCL & Ohm's law.

vii) Maximum power transfer occurs at a

a) 100 % efficiency b) 50 % efficiency

c) 25 % efficiency d) 75 % efficiency.

viii) Transient current in an RLC circuit is oscillatory when

a) $R = 2\sqrt{\frac{L}{C}}$ b) $R = 0$

c) $C = R > 2\sqrt{\frac{L}{C}}$ d) $R < 2\sqrt{\frac{L}{C}}$.

ix) An inductor does not allow sudden changes in

a) voltage b) current

c) both (a) and (b) d) none of these.

x) What is the phase angle between inductor current & the applied voltage in a parallel RL circuit ?

a) 0° b) 45°

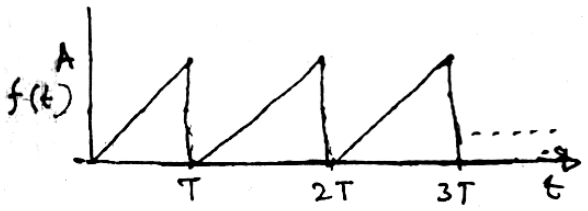
c) 90° d) 30°.

GROUP – B

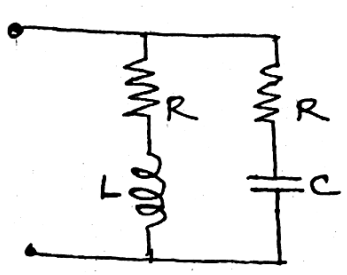
(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. Determine the Laplace Transform of the signal shown in Fig. below :



3. Determine the input impedance of the network in Fig. below assuming $L = CR^2$.

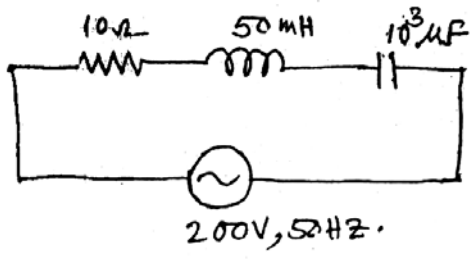


4. A 400 V, 3-phase, balanced supply delivers a power of 3 kW to a balanced 3-phase load. Determine (i) Phase voltage (ii) Phase current if the load is (a) Star connected, (b) Delta connected.

5. a) Define ideal voltage source and ideal current source and draw their V-I characteristics.

   b) A voltage source has a generated voltage of 200 V with an internal impedance of 5Ω. Convert it into an equivalent current source. The source is *D.C.* type.

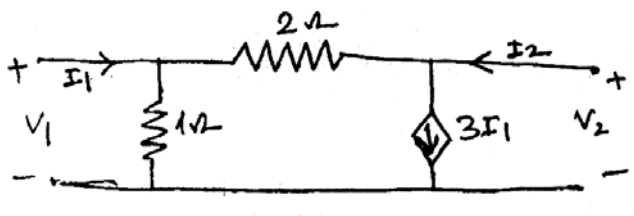
6. Draw the phasor diagram for the circuit shown below.



GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

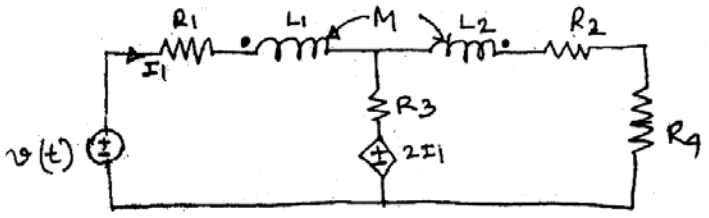
7. a) Find the open circuit impedance parameters of the two-port network shown in Fig. below :



b) Show that the condition for reciprocity of a two-port network is $AD - BC = 1$, where A, B, C, D are the transmission parameters of the network. 9 + 6

8. a) A parallel combination of $R = 10\ \Omega$ and $C = 10\ \mu F$ is connected across a 2A current source (dc) at $t = 0$. Deduce an expression for the potential difference across source assuming the initial voltage across the capacitor to be 2V.

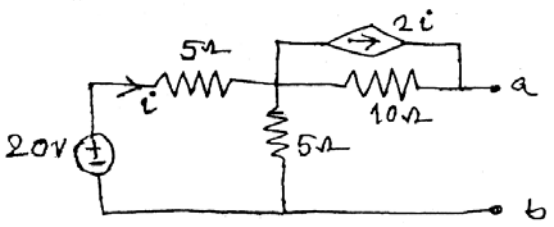
b) Write loop equation for the network of Fig. below.



8 + 7

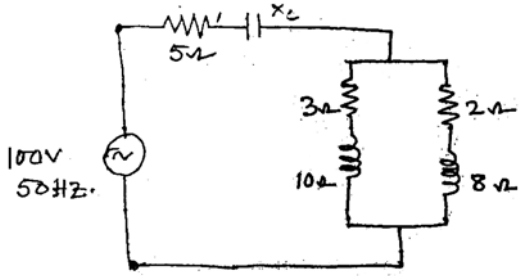
9. a) State and explain Thevenin's theorem.

b) Determine the Thevenin's equivalent of the network shown in Fig. below with respect to the pair of terminals $a - b$.



5 + 10

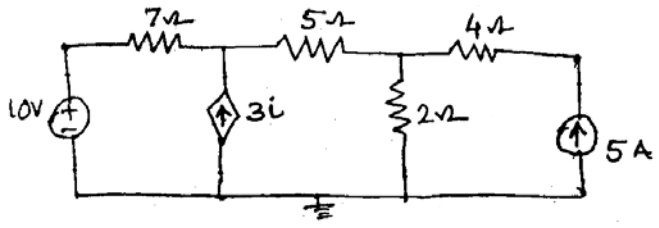
10. a) Find the value of the capacitance in the circuit of Fig. below such that the power factor of the circuit is unity.



b) Calculate the active and reactive power consumed by each of the branches of the parallel combination of impedances.

c) In the above circuit, the series branch impedance (i.e. 5Ω in series with X_c) has to be changed by an impedance Z such that maximum power is drawn by the parallel impedances from the source. Determine the value of Z_c and its components. 7 + 4 + 4

11. a) Write node equations for the network of Fig. below.



b) The transform impedance of a passive network is $Z(S) = \frac{S+1}{100}$. Determine the steady state current when it is connected across a *d.c.* voltage source $e(t) = 100u(t)$ volt.

c) How a wattmeter may be used to measure the reactive power consumed by a balanced three phase load ?

7 + 4 + 4

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