Code No: RR10204 **Set No.1**

I B.Tech. Supplementary Examinations, November/December -2005
NETWORK THEORY
(Common to Electrical & Electronic Engineering,Electronics & Communication Engineering,Computer Science & Engineering,Electronics & Instrumentation Engineering,Bio-Medical Engineering,Information Technology,Electronics & Control Engineering,Computer Science & Systems Engineering,Electronics & Telematics,Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Write a note on source transformation.
   (b) Using KCL and KVL, find the currents in all the sources of the circuit of the following figure1

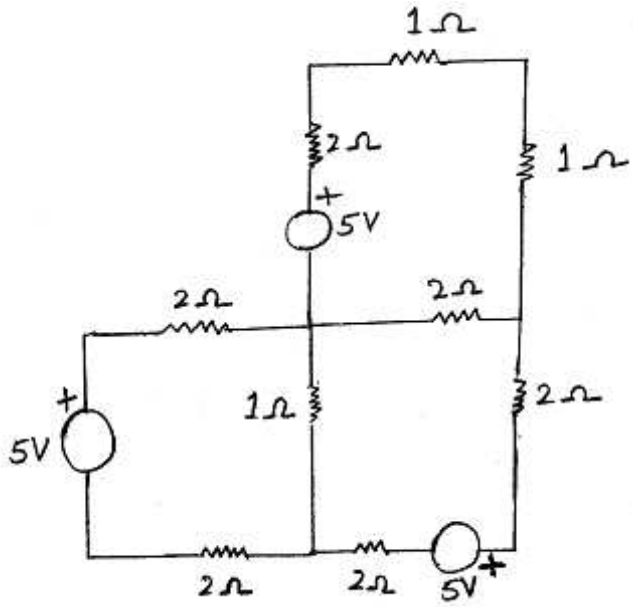

Figure 1:

2. (a) Define self inductance of a coil, mutual inductance between two coils and coefficient of coupling. Derive the relation between the self, mutual inductances and coefficient of coupling.
   (b) An iron ring has a cross section of 80 sq.mm and a mean length of 40cm. It is wound with a coil of 500 Turns. For a current of 2 Amp through the coil, the flux setup is 1.5 milliwebers. Find the relative permeability of iron under this conditions. [8+8]

3. (a) Define RMS value, average value, form factor and peak factor.

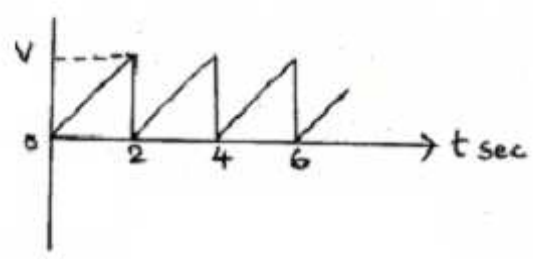

Figure 2:

(b) Find the RMS value of the wave form the following figure2.

(c) Find Z , given $V = 50\angle 30^0$Volts $I = 30\angle 60^0$Amps the following figure3. [4+6+6]

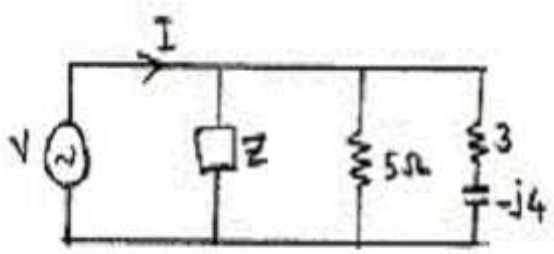

Figure 3:

4. (a) Obtain the expression for the frequency at which maximum voltage occurs across the capacitance in a series resonance circuit in terms of the Q-factor and resonance frequency.

   (b) In a series RLC circuit if the applied voltage is 10V, and resonance frequency is 1KHZ, and Q factor is 10, what is the maximum voltage across the inductance.

   (c) In a parallel resonance circuit shown in figure4 find the resonance frequency, dynamic resistance and bandwidth. [6+4+6]

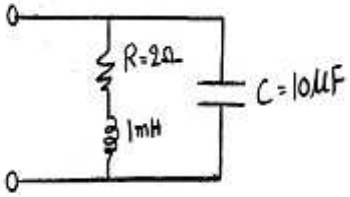

Figure 4:

5. (a) Show that two watt meters are sufficient to measure power in a 3 phase circuit. Derive the expressions for wattmeter readings for a balanced 3phase load.

(b) A 3 phase, 400v, 4wire system has a star connected load with Z_A=(10+j0)ohms, Z_B =(15+j10) ohms, Z_C=(0+j5) ohms. Find the line currents and current through neutral conductor. Draw the phasor diagram. [8+8]

6. (a) For the given network graph shown below the figure5, write down the basic Tieset matrix, taking the tree consisting of edges 2,4 and 5. Write down the KVL network equations from the matrix.

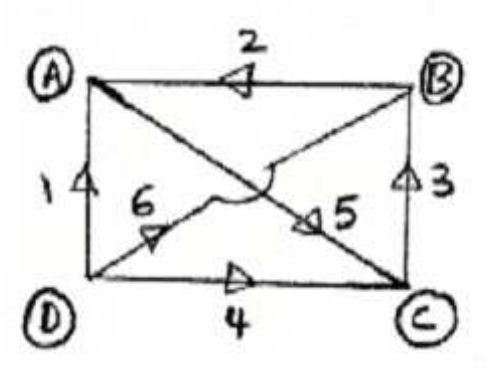

Figure 5:

(b) Find the voltage across the 5Ω resistance for the coupled network shown in figure6. [6+10]

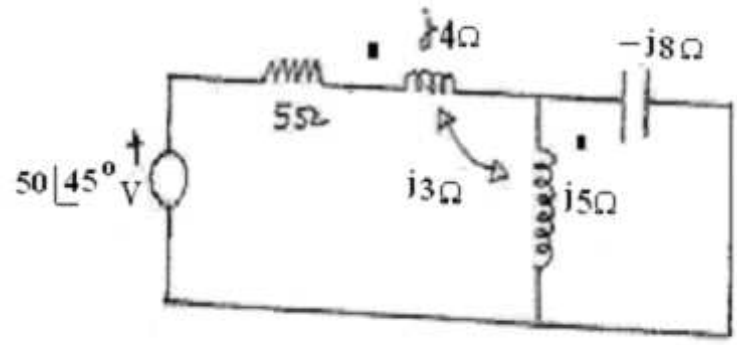

Figure 6:

7. (a) State and explain the super position theorem.
   (b) Is super position valid for power? Substantiate your answer.
   (c) Using super position theorem find Vab in the figure7. [4+4+8]

8. (a) Explain why the voltage across capacitor cannot change instantaneously?
   (b) What is the significance of time constant for R-L circuit? What are the different ways of defining time constant?

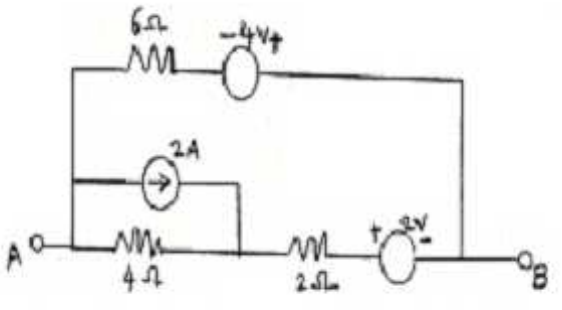

Figure 7:

(c) Switch t is close at t = 0. Find initial conditions for voltage across capacitor, i_1, i_2, $\frac{di_1}{dt}$ and $\frac{di_2}{dt}$. In the following network shown in figure8. [2+4+10]

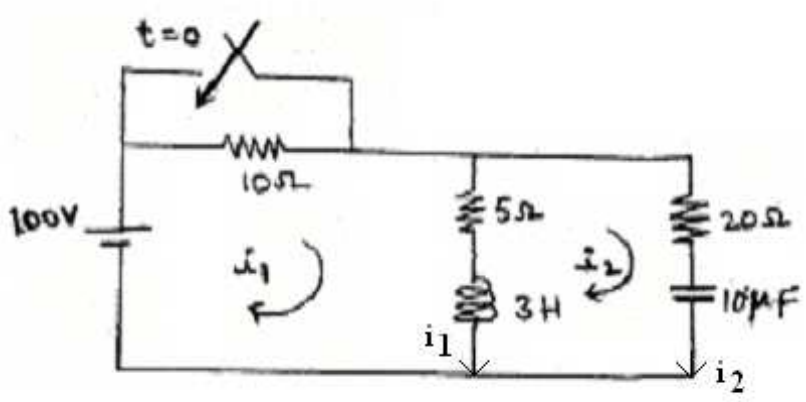

Figure 8:

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Code No: RR10204 **Set No.2**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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⋆ ⋆ ⋆ ⋆ ⋆

1. (a) If all of the resistance values in the network of Figure 9 are 1 ohm, what is the equivalent resistance across the terminals X and Y? How does the result change if the outer two resistors are both replaced by short circuits?

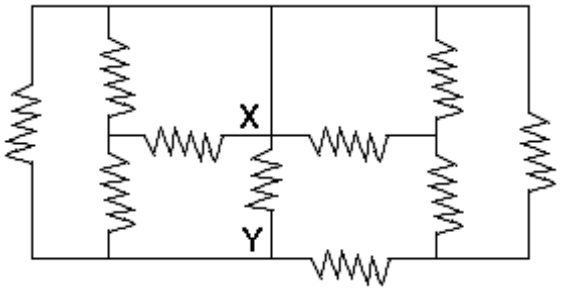

Figure 9:

(b) Determine the necessary values of v and i in the network shown in figure10

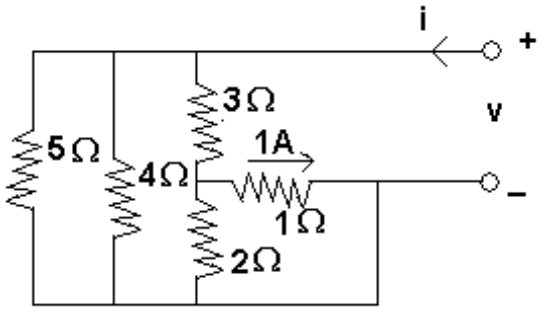

Figure 10:

2. (a) Explain the concept of self inductance and mutual inductance.
(b) Two similar coils are wound on the same core. The resistance of each coil is 10 ohm. When excited by a 100 V, 50 Hz source, the first coil takes 2A, and the induced emf in the second coil is 50V. Determine the self and mutual inductances. [6+10]

3. (a) Find the form factor for the following figure11 wave form.

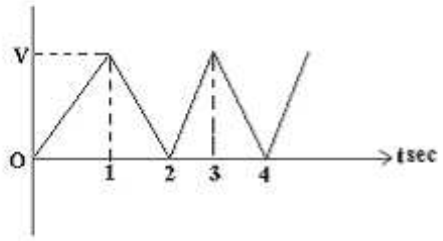

Figure 11:

(b) Find the branch currents, total current and the total power in the circuit shown in figure12. [8+8]

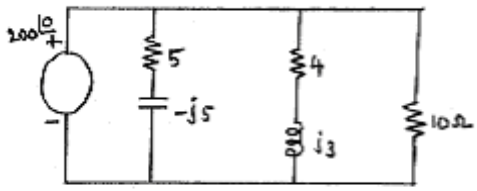

Figure 12:

4. (a) Obtain the expression for frequency at which the voltage across the inductance becomes a maximum in a series RLC circuit. Explain what is meant by voltage magnification factor.

(b) Obtain the transmission parameters for the circuit in figure13 . Verify your result for reciprocity condition. [6+10]

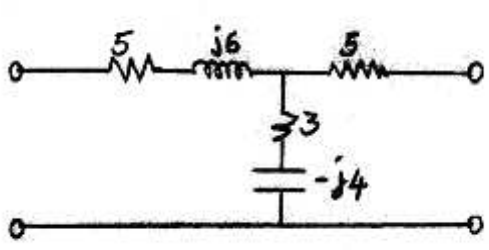

Figure 13:

5. (a) Derive the expressions for two wattmeter readings used to measure power in balanced 3 phase loads.

(b) A balanced, 3 phase, load is supplied from a symmetrical 3 phase, 400v, systems. The current in each phase is 30A and lags by 30^0 behind the phase voltage. Find the impedance and total active and reactive power if the load is star connected. [8+8]

6. (a) Define the following:
   i. Oriented graph
   ii. Tree of a graph
   iii. Cut set and a Basic Cut set and
   iv. Tieset & Basic Tieset.

   (b) For the topological graph shown in the figure14, obtain the fundamental Tieset matrix choosing the tree containing two elements 5 & 6.

   (c) Derive expression for elements of m-derived low pass T filter in terms of proto type T network. [4+4+8]

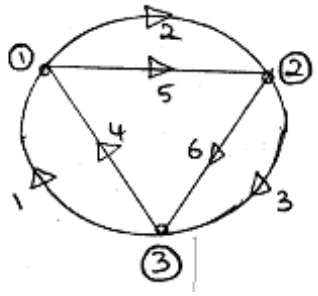

Figure 14:

7. (a) State and explain Tellegen's theorem.

   (b) Find the current in 5 Ω resistor using superposition theorem for the following network shown in figure15. [4+12]

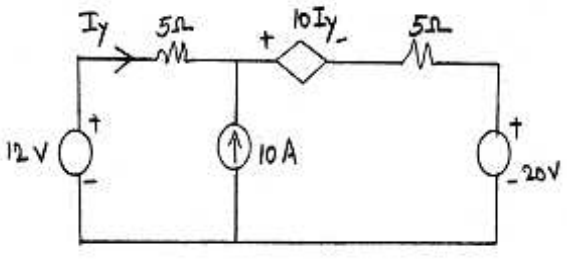

Figure 15:

8. (a) In the series R – L – C circuit
   i. Find the current i(t) , where $\nu(t) = 100$ Sin 1000t in the following figure16

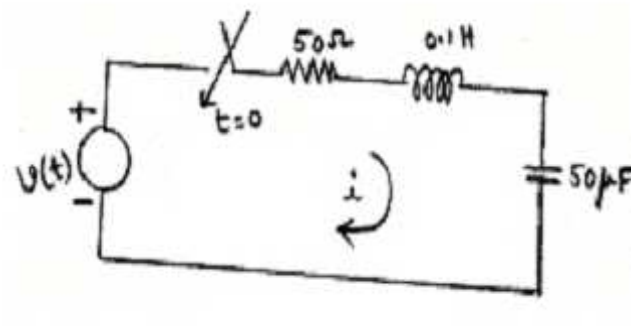

Figure 16:

(b) Find i(t) for t $\geq$ 0 when the switch is moved from position 1 to 2 at t = 0. The switch was in position 1 for a long time in the network shown in figure17. [8+8]

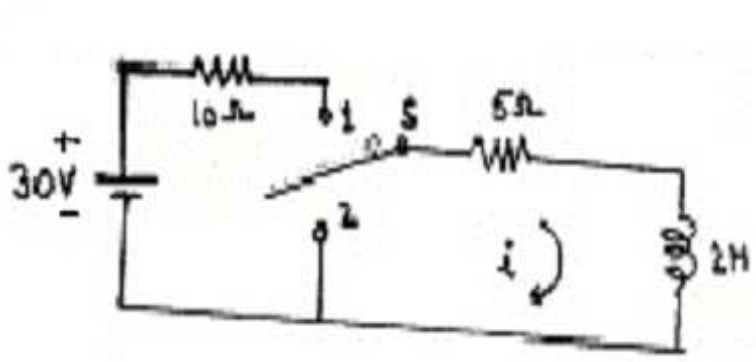

Figure 17:

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Code No: RR10204 **Set No.3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Write a note on independent and dependent sources.
   (b) What is the value of R such that the powers supplied by both the sources are equal as show in figure18. [4+12]

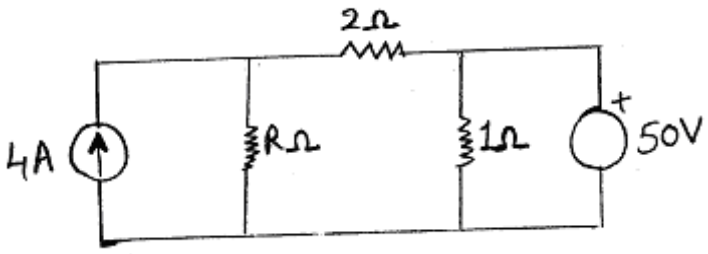

Figure 18:

2. (a) Define coefficient of coupling, magnetomotive force, reluctance, and permeability.
   (b) Two coupled coils with L_1=0.02H, L_2=0.01H, and K=0.5 are connected in four different ways : Series aiding, series opposing, and parallel with both arrangements of the winding sense. What are the four equivalent inductances? Derive any formulae used. [4+12]

3. (a) Explain the significance of J – operator ? What are the different forms of expressing the sinusoidal quarter in complex form?
   (b) Find the components of Z such that the current drawn quantity by the circuit same at all frequencies the following figure19.

4. (a) The circuit shown in figure20 is resonant for two values of C when the frequency of the supply is 5000 rad/sec. Find the values of C and draw the admittance locus.
   (b) Find the y-parameter of the two port network shown in figure21.

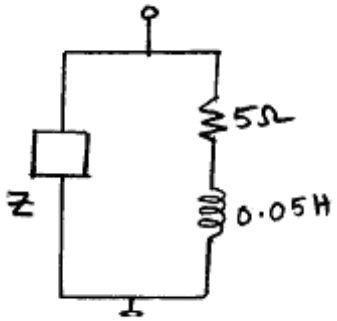

Figure 19:

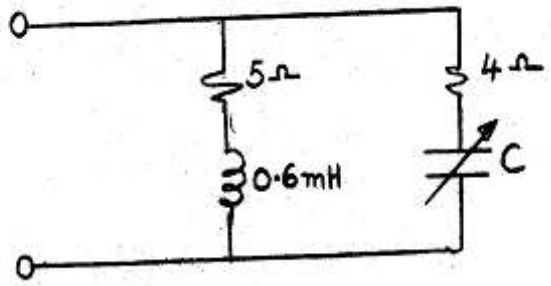

Figure 20:

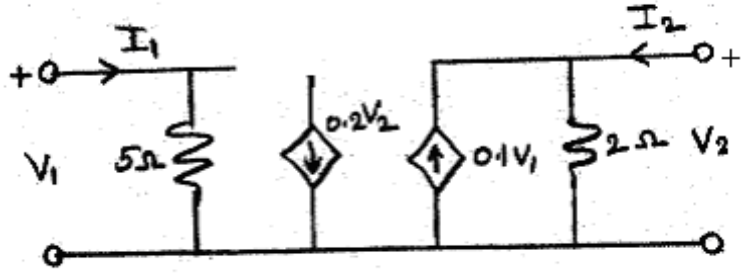

Figure 21:

5. (a) A balanced 440V, 3 phase system has a delta connected load with $Z_{AB} = 25\angle 90^0\Omega$ $Z_{BC} = 15\angle 30^0\Omega$ $Z_{CA} = 20\angle 0^0\Omega$. Obtain the phase & line currents. Draw the phasor diagram. Phase sequence is ABC.

   (b) Derive the expressions for wattmeter readings in Two wattmeter method with balanced star connected load. How do you calculate the power factor of the balanced load from wattmeter readings. Discuss the effect of power factor on the readings of the watt meters in the above method. [8+8]

6. (a) For the circuit shown below the figure22, find the currents & voltages in all the branches of the circuit. Use Node Voltage method.

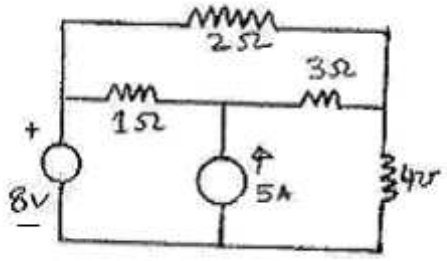

Figure 22:

   (b) Draw the dual of the network shown below the figure23. Explain the procedure employed.

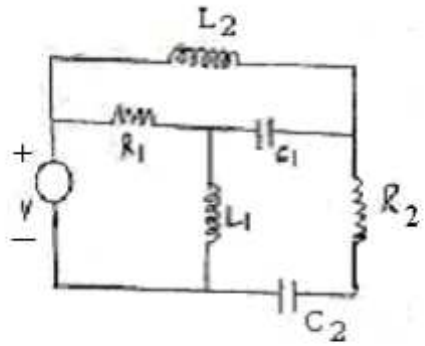

Figure 23:

   (c) Obtain the expression for characteristic impedance of a symmetrical T network. [8+4+4]

7. (a) State and explain the Maximum power transfer theorem.

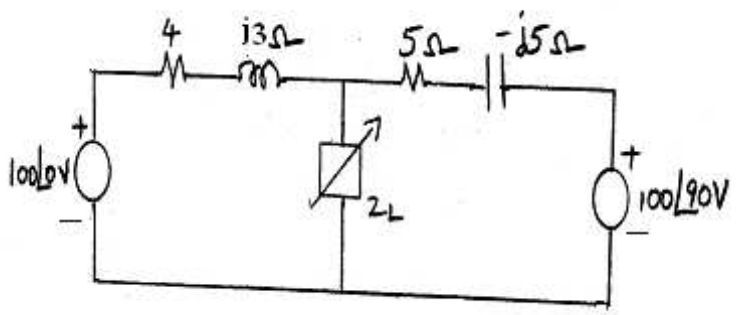

Figure 24:

(b) Find the maximum power received by Z_L. Also find the Max power for the network shown in figure24. [6+10]

8. (a) Derive the expression for i(t) for R – L series circuit when excited by a sinusoidal source.

(b) For R – L – C series circuit with R = 10Ω, L = 0.2 H, C = 50 micro farads, determine the current i(t) when the switch is closed at t = 0. Applied voltage is V(t) = 100 Cos $(1000\ t + 60)^0$. [8+8]

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Code No: RR10204 **Set No.4**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) State and explain KCL and KVL .
   (b) Distinguish between.
      i. independent and dependent sources
      ii. Ideal and practical sources.
   (c) Find V_s if $r_1 = 2\ \Omega$ $r_2 = 1\ \Omega$ $r_3 = 5\ \Omega$ the following figure25. [2+2+2+2+8]

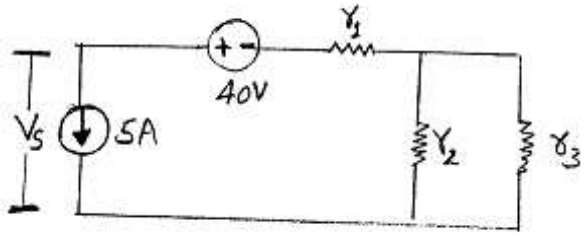

Figure 25:

2. (a) Derive the expressions for self inductance and mutual inductance in terms of number of turns, flux and current in a coupled circuit.
   (b) Two coils, of self inductances L_1=2H, L_2=4H are coupled in such a way that M=1.5H. Assuming the mutual inductance to be positive as per the dot convention, find the amount of energy stored after 0.2 sec for the circuit connected to a d.c. source of 12V. [6+10]

3. (a) Define Reactance, suceptance, impedance and admittance.
   (b) A voltage of 240V applied to a pure resistor, pure capacitor and an inductor in parallel. If the total current and the currents in the resistor, capacitor and inductor are respectively 2.3 A, 1.5A, 2A and 1.1A Find the over all power factor and the power factor of the inductor. [6+10]

4. (a) For a series RL circuit obtain the locus of current as inductance is changed form 0 to ∞ when the applied voltage is constant

(b) Show that for a series resonant circuit $f_1\ f_2 = f_r^2$ where f_1 and f_2 are half power frequencies and f_r is the resonance frequency.

(c) Obtain the z-parameters of the following (figure26) Two port network.[6+4+6]

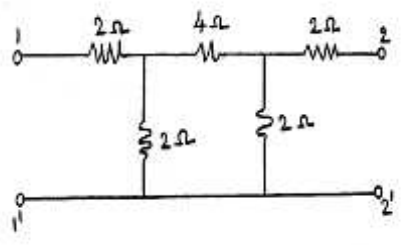

Figure 26:

5. (a) A balanced Delta connected load of $5.0\angle 30^0$ohms and a balanced star connected load of $5.0\angle 45^0$ohms are supplied by the same balanced 240V, 3 phase ABC system. Obtain line currents I_A, I_B and I_C.

(b) Two watt meters in a 3 phase, 3 wire system with an effective line voltage of 120V read 1500W and 500W. What is the impedance of each arm of the balanced delta connected load? What is the power factor of the load. [10+6]

6. (a) Determine the equivalent input (Zab) impedance of the network shown the following figure27 using loop method of analysis.

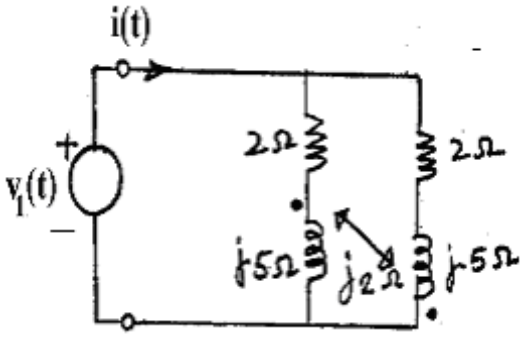

Figure 27:

(b) Find the current in the 3 Ω resistor for the circuit shown the following figure28. [8+8]

7. (a) State and explain Millmann's theorem.

(b) Using Millman's theorem find the Neutral shift voltage Von in the network shown in figure29. [6+10]

8. (a) Compare the classical and laplace transform method of solution of the network.

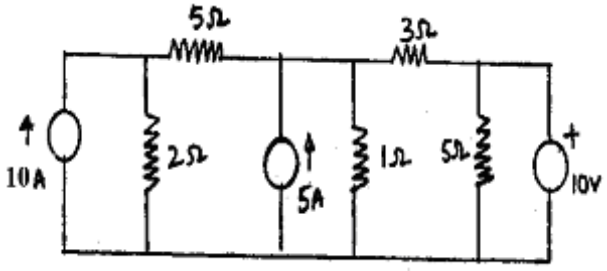

Figure 28:

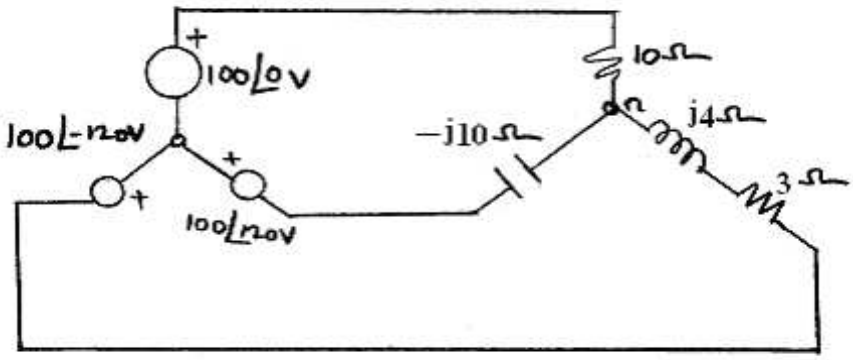

Figure 29:

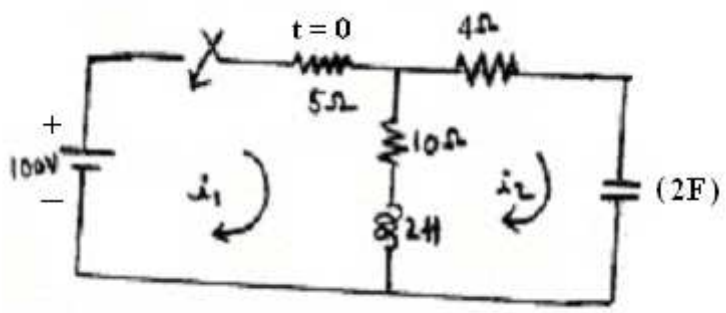

Figure 30:

(b) Draw the network in laplace domain and find $i_1(t)$ and $i_2(t)$in the following network shown in figure30 [4+12]

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