The Open University of Sri Lanka
Department of Electrical and Computer Engineering
Diploma in Technology/Bachelor of Technology - Level 03

ECD1204 – Circuit Theory
Final Examination 2005

Duration: 3 hours

Date: 18.04.2006 Time: 0930 – 1230 hrs.

Answer ***five*** questions.
All questions carry equal marks

Q1

(a) Obtain the Thevinin's equivalent circuit required to determine the current through impedance Z of figure Q1 using source conversion

(b) Draw the Notron's equivalent circuit using the answer for Q1 (a)

(c) Find the short circuit current through the resistor R if R_A is infinity

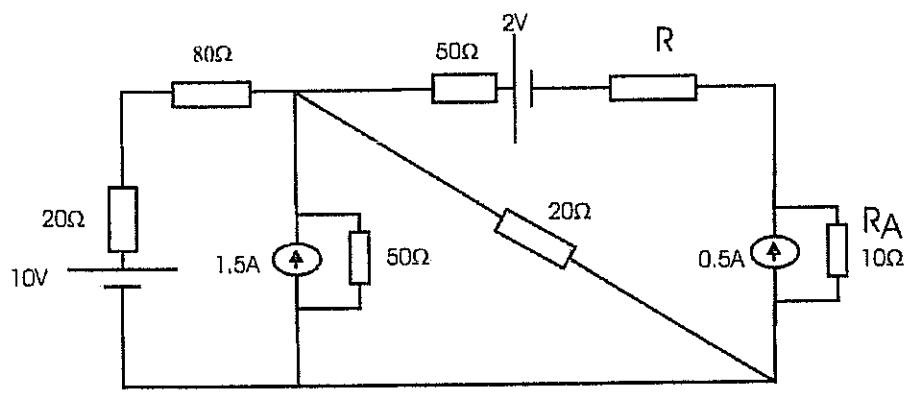

Figure Q1

Q2 A balance star connected load having impedance of (10 + j3) Ω on each phase is connected to a balance supply of 415V line voltage using connecting wires having impedance of (3 + j1) Ω.

(a) Find the line current

(b) Find the phase voltage at load

(c) Find the power delivered to each load

(d) Sketch the phasor diagram for the line and phase voltages at the load

Q3

(a) Use superposition theorem to obtain the Thevinin's equivalent circuit that required to determine the current through the load impedance Z_L of the network shown in figure Q3.

(b) Estimate the maximum possible power that can be delivered to the load and impedance Z_L at which this maximum amount of power is appearing.

(c) Is it possible to obtain the same amount of maximum power to Z_L at another frequency?

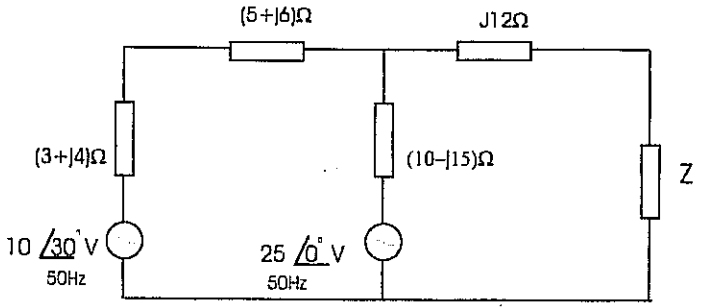

Figure Q3

Q4 An electrical circuit is shown in figure Q4

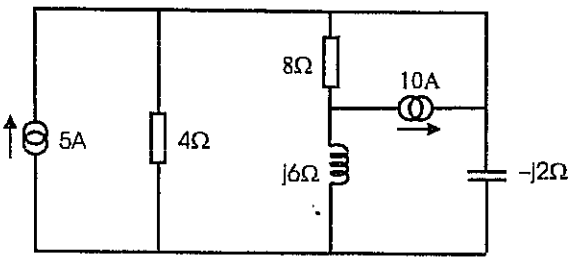

Figure Q4

For the circuit shown in figure Q4

(a) Find number of nodes and branches

(b) Draw the oriented graph for the circuit

(c) Find the cut-set matrix and nodal admittance matrix

Q5 A circuit contains series connected 5Ω resistor, 10uF capacitor, and a 90mH inductor. If the following voltage is supplied to the circuit:

$$v(t)=60+100\sin(100\pi t)+30\sin(300\pi t-90^0)+80\sin(500\pi t+30^0)$$

Find

(a) Instantaneous value of current through the circuit

(b) Active and reactive power delivered from the source

Q6

(a) Obtain Y parameters for the two networks shown on figure Q6 (a) and (b).

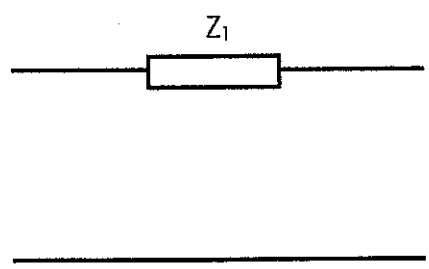

Figure Q6 (a)

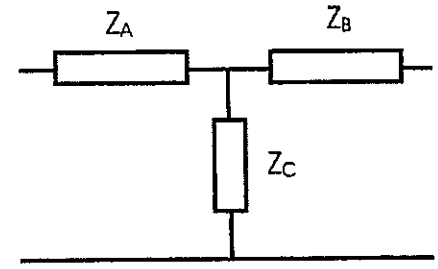

Figure Q6 (b)

(b) Hence or otherwise estimate the I_1/I_2 ratio for the network shown in figure Q1 (c).

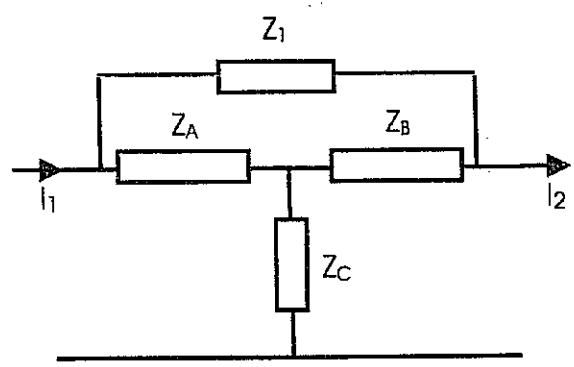

Figure Q6 (c)

Q7

(a) Determine the open circuit voltage transfer ratio for the filter shown in figure_Q7.

(b) If above circuit is used as a second order LC Low Pass Filter, determine the type of reactive component that should used for Z_1 and Z_2 using upper and lower limits of the open circuit voltage transfer function.

(c) Determine the pass band of the LPF filter by assigning L/2 and C for appropriate components

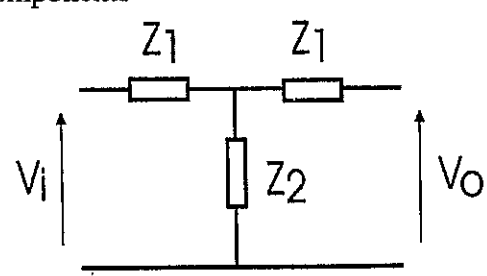

Figure Q7

(d) Draw the circuit diagram of π – type LC band pass filter

Q8

(a) Derive an expression for the driving point impedance Z(s) of the network show in Figure Q8. Hence identify the poles and zeros of the driving point impedanc Z(s).

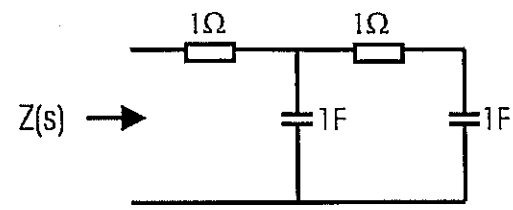

Figure Q8

(b) Realize **First Foster** form of the following impedance function. Henc determine the frequencies at which driving point impedance is infinite.

$$Z(S) = \frac{S^4 + 14S^2 + 32S + 40}{2S^3 + 8S}$$

(c) Realize **Second Cauer** form of the impedance function given below.

$$Z(S) = \frac{2S^2 + 6S + 1}{2S + 2}$$