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

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ECX3231 - Electrical Circuits & Measurements
Final Examination 2005

Duration: 3 hours

Date: 08.05.2006 Time: 9.30-12.30

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

Q1

(a) Use super position theorem to find the open circuit voltage across the impedance Z of the circuit shown in Figure Q1.

(b) Find the Thevenin's equivalent circuit required to determine the current through the impedance Z.

(c) Determine the maximum achievable power across the impedance Z.

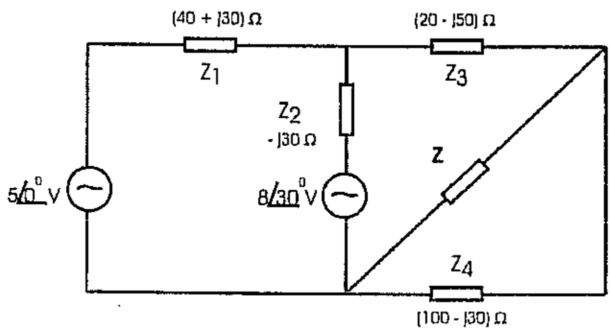

Figure Q1

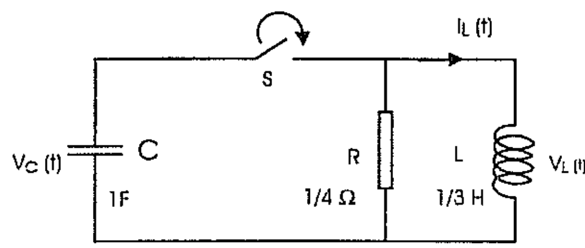

Figure Q2

Q2 The switch S of the circuit shown in Figure Q2 is closed at t = 0 and initial circuit conditions of the circuit are $V_c(-0) = 10$ V and $I_L(-0) = 0$ A

(a) Determine the general form of the voltage across the inductor $V_L(t)$

(b) Obtain an expression to evaluate the instantaneous voltage across the inductor $V_L(t)$.

(c) Show that the initially stored energy in the capacitor is completely dissipating through the resistor as **t** tends to infinity.

(d) Sketch the variation of voltage across the inductor without actually solving the circuit if inductance of the inductor is 100mH.

Q3 For the circuit shown in Figure Q3

(a) Write the tie set matrix.

(b) Write the branch impedance matrix and branch emf vector

(c) Determine the mesh impedance matrix.

(d) Determine the mesh emf vector.

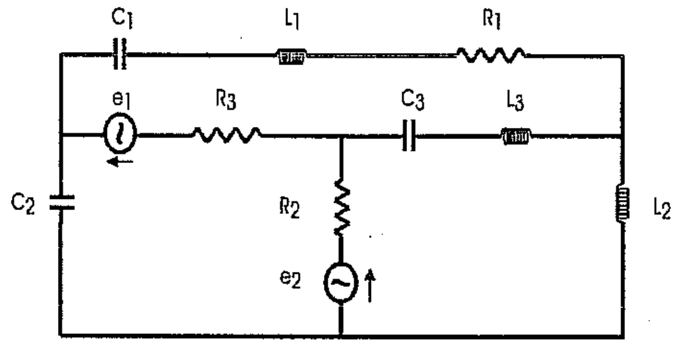

Figure Q3

Q4

(a) List the observations that required to determine the Y parameters of a symmetrical T network.

(b) Determine the ABCD parameters for the T network shown in Figure Q4.(a) in terms of Z_1 and Z_2.

(c) Obtain Y parameters of the above T network by using determined ABCD parameters.

(d) Hence or otherwise, determine the Y parameters of the twin T network shown in FigureQ4.(b)

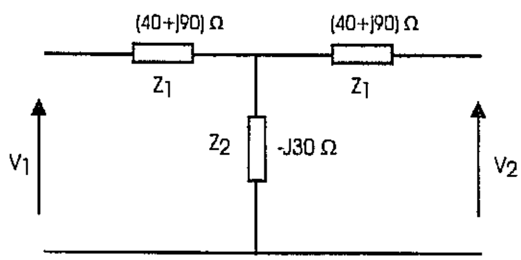

Figure Q4.(a)

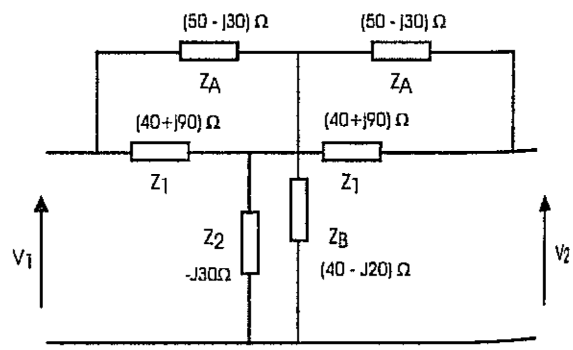

Figure Q4.(b)

Q5

(a) For the bridge circuit shown in Figure Q5, determine the self-inductance L_1 and resistance R_1 in terms of bridge components at the balance condition. You may follow below instructions to obtain the balance equations.

1) Equate potential differences between **bc** to **ce**

2) Potential difference between nodes **ab** is equals to nodes **ade**

3) Voltage drop across R_4 is same as potential difference between **dec**

(b) Select two components that causes easy convergence to the balance condition

(c) Draw the phasor diagram indicating the voltages across each element at balance condition.

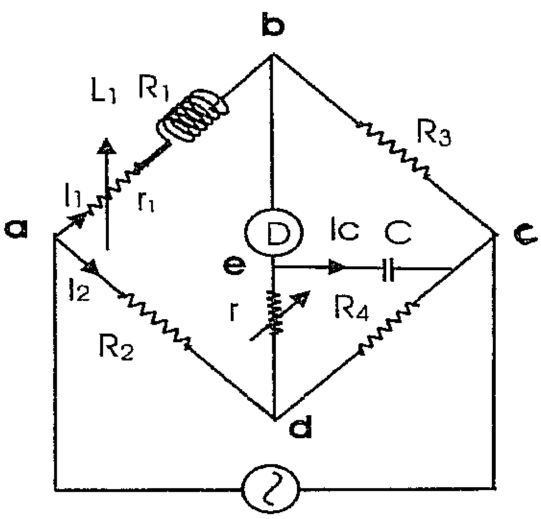

Figure Q5

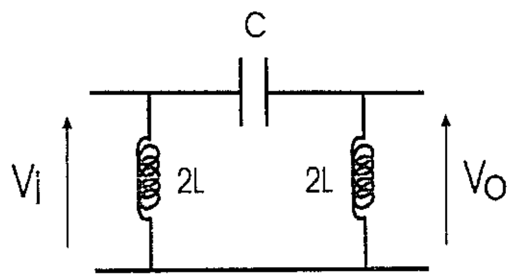

Figure Q6

Q6

(a) Determine the open circuit impedance $Z(s)_{oc}$ and short circuit impedance $Z(s)_{sc}$ for the LC filter circuit shown in Figure Q6.

(b) Determine the type and pass band of the given filter by using reactance sketches.

(c) If inductance L is 4.77 mH and capacitance C is 0.01326 uF, find followings;

(i) Characteristics impedance and phase constant at 25 KHz

(ii) Attenuation at 5 KHz

Q7

(a) List three features of a realizable driving point impedance function using L and C elements.

(b) Partial factored form of a driving point impedance function contains a pole at origin, a pole at infinity, and a complex conjugate pair of poles. Show the configuration of the LC network corresponds to the above driving point impedance function.

(c) Realize first Foster form of the RL impedance function $Z_1(s)$ given below

(d) For the Determine the first Cauer form of the driving point impedance function $Z_2(s)$ given below.

$$Z_1(s) = \frac{(2s^2+6s+1)}{(2s+2)} \qquad Z_2(s) = \frac{(12s^4+10s^2+1)}{(4s^3+2s)}$$

Q8

(a) Explain how the capabilities of measuring DC voltages, AC voltages, resistances, and extensions of DC ammeter range are integrated to a basic Permanent Magnet Moving Coil instrument to use it as a multi meter.

(b) A DC voltmeter having sensitivity of 20 kΩ/V is used to measure voltage across the resistor R of Figure Q8. Determine the meter reading, if the voltmeter selector switch is positioned at 10 V.

(c) A symmetrical square wave voltage having amplitude A (V) is applied to an average value responding ac voltmeter having a scale calibrated in terms of rms value of a sine wave. By assuming the meter rectifies any negative voltages before taking average value, calculate

(i) The form factor of the square wave voltage

(ii) The error in meter indication

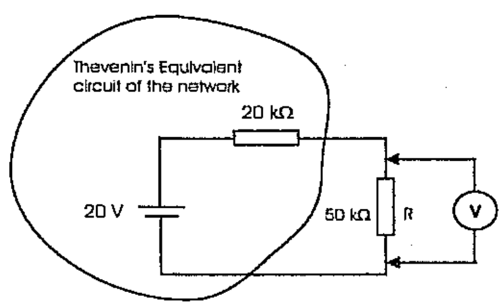

Figure Q8