00204

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

ECX3231 - Electrical Circuits & Measurements
Final Examination 2010/2011

Duration: 3 hours

Closed Book

Date: 09.03.2011 Time: 13.30-16.30

This question paper consist of two sections over four pages. Answer **six** questions selecting **at least three questions from section A and at least two questions from section B.** All questions carry equal marks.

SECTION -A

Q1. A Linear passive network is shown in the figure Q1.

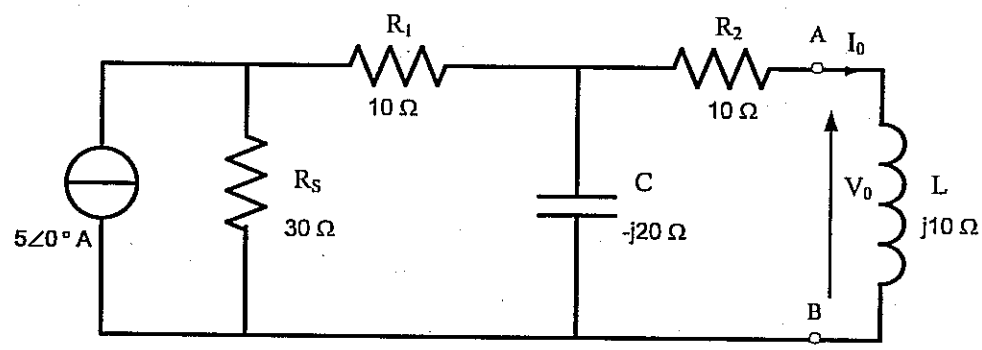

Figure Q1

(a) Use source conversion technique to find the Thevenin's equivalent circuit across the terminal A-B

(b) Hence, determine the output voltage V_o

(c) Use result in Q1.(a) to determine the maximum available power across the terminals A-B

Q2. Use loop/mesh current method to formulate and solve the passive ladder network presented in the figure Q2.

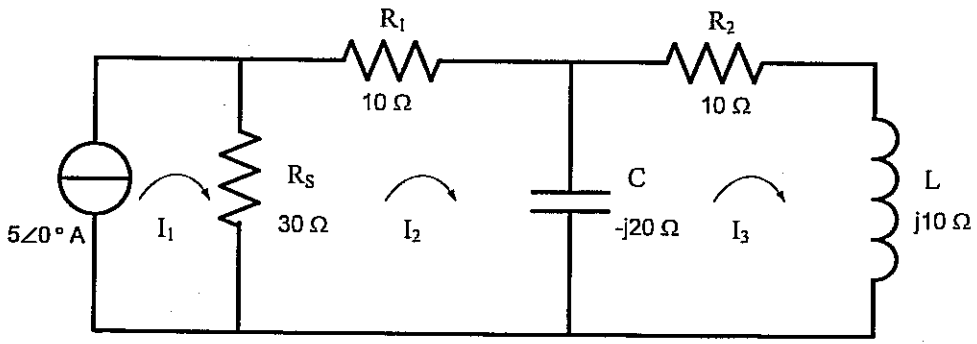

Figure Q2

(a) Formulate the circuit shown in the figure Q2 using the loop/mesh current method

(b) Solve the formulation to obtain loop currents

(c) Determine current through each component using the loop currents

Q3. Analyze the network shown in the figure Q3 using the two port network approach.

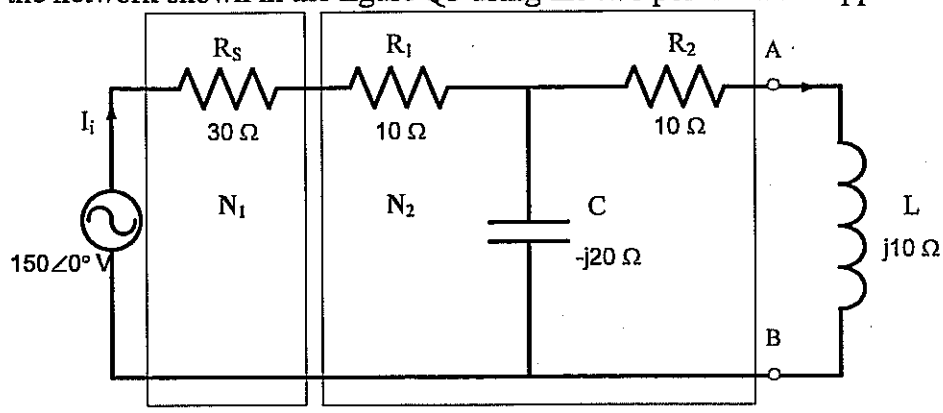

Figure Q3

(a) Determine the transmission parameters of the symmetrical section labeled as N_2

(b) Find transmission parameters of the network using the cascade result of the two individual networks N_1 and N_2

(c) Use result in Q3.(b) to find the input current I_i when an inductor of reactance j10Ω is loaded at the output

Q4. Analyze driving point impedance characteristics and step response using the pole zero analysis.

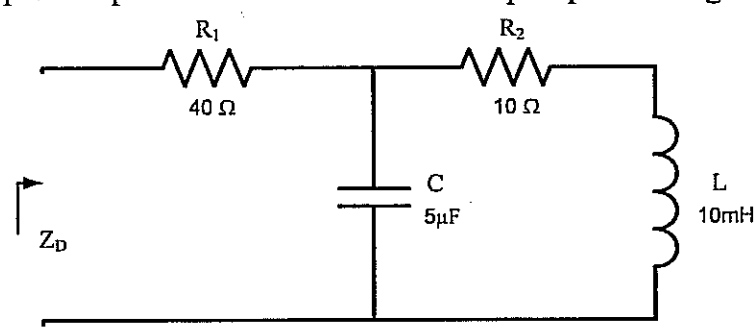

Figure Q4

(a) Determine the driving point impedance of the circuit in figure Q4

(b) Plot poles and zeros of the driving point impedance function in s plane

(c) Determine the dominant pole and hence, plot approximate step response indicating time variation of the output at a unit step input

Q5. The circuit shown in the figure Q5 is at steady state and the switch is closed at t=0.

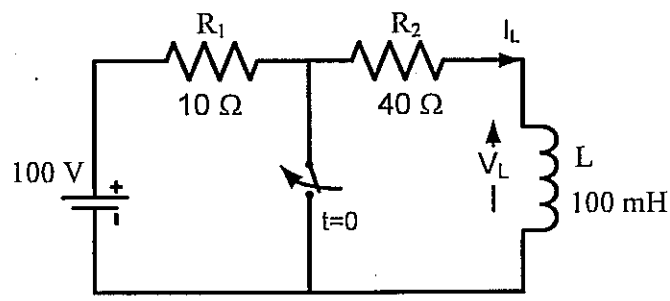

Figure Q5

(a) For t ≥0, write equations for inductor current and voltage across it

(b) Determine the inductor current and voltage across the resistor R_2 at t=5mS

(c) Draw waveforms of the current through and the voltage across the inductor with typical values for t ≥0 and until decaying the energy stored in the inductor

Q6. Perform frequency response analysis for the circuit in the figure Q6 with help of the steps given below.

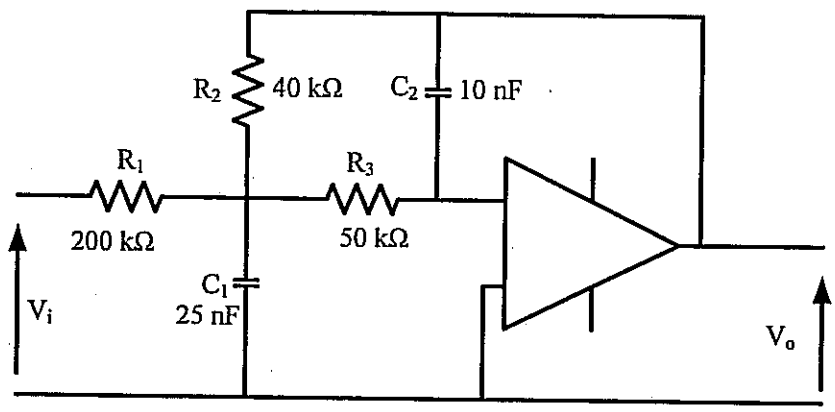

Figure Q6

(a) Derive the transfer function of the filter circuit

(b) Find mid band gain and cut off frequencies (if any) for the circuit

(c) Determine output voltages for the following inputs

i. Ten Volts input at 20 Hz

ii. Input of 10 Volts input at 1000 rad/sec

SECTION-B

Q7. Magnetic properties of materials can be measured with help of certain techniques which are based on some principles. Answer the following questions with reference to the magnetic measurements and measuring techniques.

(a) Briefly explain one method of determining hysteresis loop of magnetic materials

(b) Briefly describe how eddy current loss and hysteresis losses are separated from iron loss

(c) A Lloyd Fisher square test setup is used to measure iron loss of a magnetic material. If each of the winding has 500 turns with mean magnetic path length is 1m. The primary wingding is fed by 240V fifty hertz sinusoidal supply and the measured primary current is 0.35A. The resistance of each secondary wingding is 20 Ω and wattmeter has resistance of 100 kΩ. Determine followings

I. Peak values of the magnetic field and flux

II. Iron loss if the wattmeter reading is 100W

Q8. Figure Q8 indicates a bridge used to measure mutual inductance of a coil.

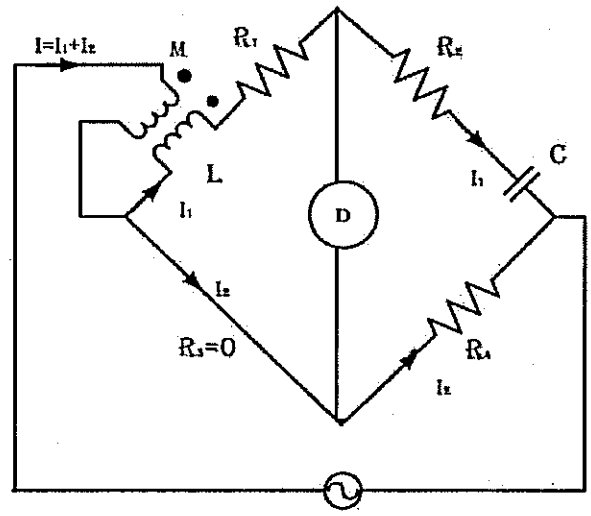

Figure Q8

(a) Find mutual inductance M and Self inductance L in terms of the values of other components

(b) Determine M and L, if the other components are such that

R_1 =200 Ω R_2= 121.25 Ω R_4=100 Ω C_2=0.9175 uF.

(c) Draw phasor diagram indicating voltages and current at the balance

Q9. Write short notes or a brief explanation on four of following topics.

(a) Applications of AC Potentiometers

(b) One method of measuring high resistances

(c) Techniques use to minimize errors in the AC bridges

(d) Use of FETs in the input stages of electronic instruments

(e) Compare conversion times of Successive Approximation type DVM with Single Ramp type DVM

Q10. Digital multi meters are digital electronic version of conventional analogue multi meters. These two types of instruments have different building blocks and their own relative advantages and disadvantages. Answer the following questions relevant to the construction as well as merits and demerits of the digital versus analogue.

(a) Draw functional block diagram of a digital multi meter.

(b) Briefly explain important electronic blocks that determine the performances of the digital multi meters.

(c) Compare advantages and disadvantages of analogue multi meters with digital multi meters.