Derive the Thevenin's equivalent e.m.f. and impedance as seen between the terminals AB.

(Note:You must show the simplified version of the circuit that you are working on when applying the theorem).

**b.** Draw the Thevenin's equivalent circuit derived in Part a. above, hence determine the expression for the current iout

**c.** Given that  is an inductor of 22 mH and  is a capacitor of 40 nF, calculate:-

i. The Thevenin impedance.

ii. The Thevenin voltage.

iii. The current iout.

Data: Frequency = 24 kHz.,  &  = 75 Ω, and V.

**Z**2

**B**

**Z3**

**VOUT**

**Z1**

**Vin**

Figure 5-1

**A**

**ZL**

iout

**C**

**L**

**Vin**

**Vout**

**A**

**B**

Figure 5.2

**RS**

i1

i2

a. Using Maxwell’s circulating current show that 

(assume that no current flows to the output terminals AB).

1. Derive the transfer function when the frequency 
2. Explain, with reason, whether the output signal in part b. is in phase with the input signal and what that implies about the effective impedance of the LC combination.

Figure 5-3 represents the equivalent circuit of a voltage regulator where an unregulated 12V source is used to provide a stabilised voltage Vout using an 8V zener diode.

i2

**i3**

**i1**

**RZ**

**R2**

**0.5 **

**500 **

**8 V**

**100 **

**12 V**

**C**

**D**

**B**

Figure 5-3

**R1**

**10 **

**A**

**R3**

**VZ**

**Vout**

Using Kirchhoff’s voltage law and by writing the appropriate equations find:

i. The currents i2 & i3.

ii. The output voltage **Vout**.

iii. The power dissipated by the zener diode (resistor RZ).

A p.d. of  V is connected between terminals A and B of the network below:-

**A**

**B**

**C1**

**120 pF**

**8 µH**

**L**

**R = 14 **

**C2**

**10 nF**

Figure 5-4

For a frequency of 32.274861 kHz calculate :

a. The j notation impedance of the network.

b. The polar representation of the impedance in the form  giving the answer as a positive angle.

c. The magnitude of the voltage across C2 and its phase relative to the supply voltage.