Indraprastha Institute of Information Technology, Delhi

End-Sem Examination

ECE 113 Basic Electronics

Date: 4.8.2022 Maximum Marks: 60 Time: 2.00 – 4.00 pm

All questions are compulsory.

1. (a) For the op-amp circuit shown in fig. 1(a), determine the gain $A_v = v_0/v_i$.

   (b) Find V'_f / V_o for the circuit shown in Fig. 1(b)

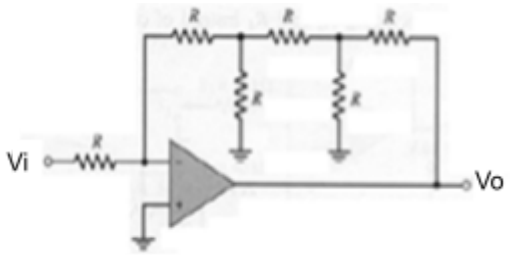

Figure 1(a)

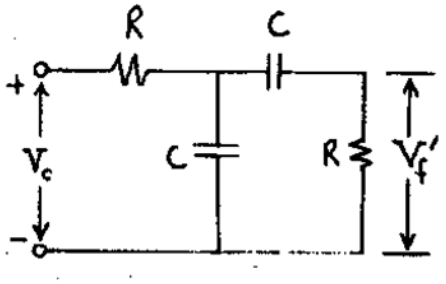

Figure 1(b)

[2x5 = 10 Marks]

2. (a) For the circuit shown in Fig. 2(a), find the transfer function V_o/V_s.

   (b) Determine V_{OUT} for the circuit shown in Fig. 2(b) given that V_{IN} is a 100-kHz square wave that switches between 0 V and 5 V. The buffer in the circuit produces an output of 0 V for an input of 2.5 V and below; it produces an output of 5 V for an input above 2.5 V. Assume that the diode is ideal.

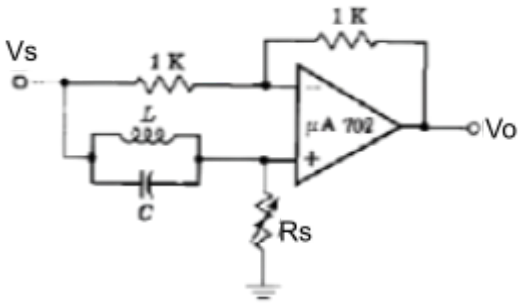

Figure 2(a)

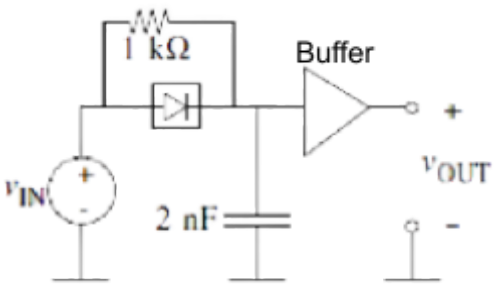

Figure 2(b)

[2x5 = 10 Marks]

3. (a) The diode in the networks shown in Fig. 3(a) is ideal. The circuit is driven by a voltage source v_s = A sin(ωt) V and control signal v_c is a square periodic pulse as shown in Fig. 3(b). Draw the output v_0.

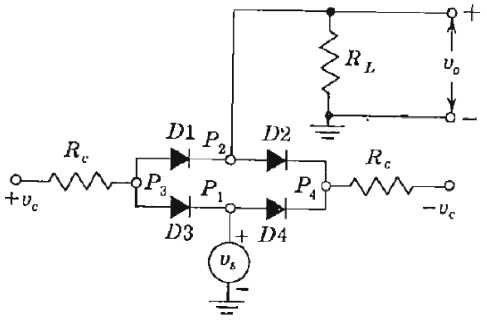

Figure 3(a)

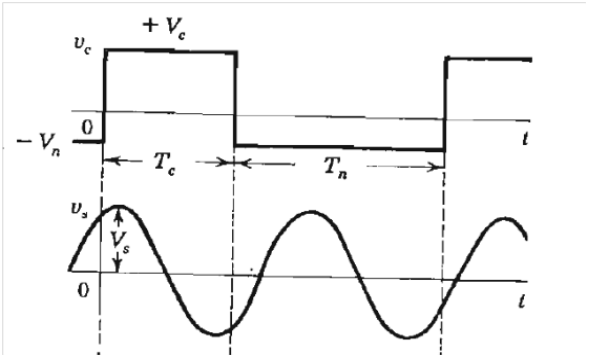

Figure 3(b)

(b) You have a 6 Volts ideal battery and a 1.5 Volts connected with flashlight bulb, which is known to draw 0.5 A when the bulb voltage is 1.5 V in Fig. 3(c). Design a network of resistors to go between the battery and the bulb to give v_2 = 1.5 V when the bulb is connected, yet ensure that v_2 does not rise above 2 V when the bulb is disconnected.

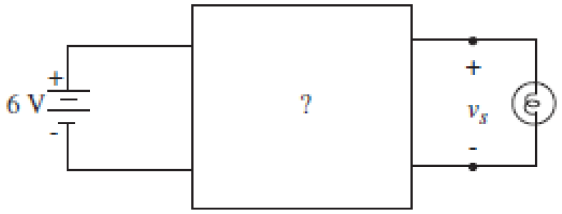

Figure 3(c)

[2x5 = 10 Marks]

4. (a) Obtain the Norton's equivalent network for Fig. 4(a) across terminal A-B.

   (b) Find the value of Z_L for maximum power transfer in the network shown in Fig. 4(b). Find the maximum power.

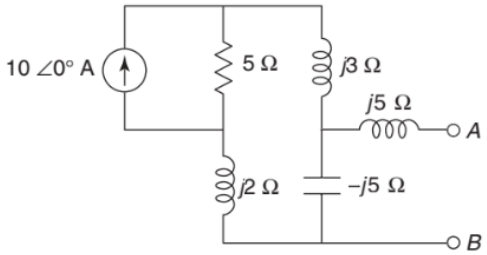

Figure 4(a)

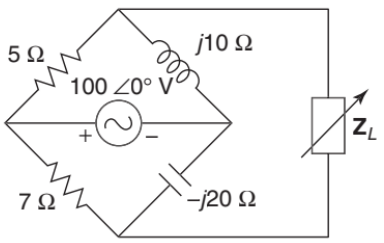

Figure 4(b)

[2x5 = 10 Marks]

5. (a) Find the current I_0 in the network of Fig. 5 (a).

   (b) Find the current I and verify the reciprocity theorem for the network shown in Fig. 5 (b)

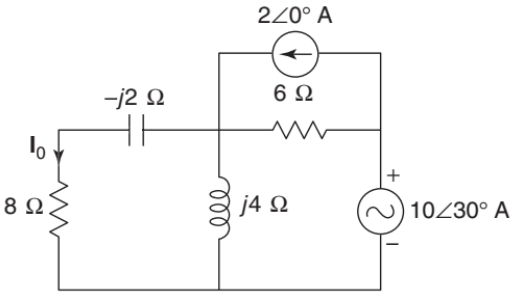

Figure 5(a)

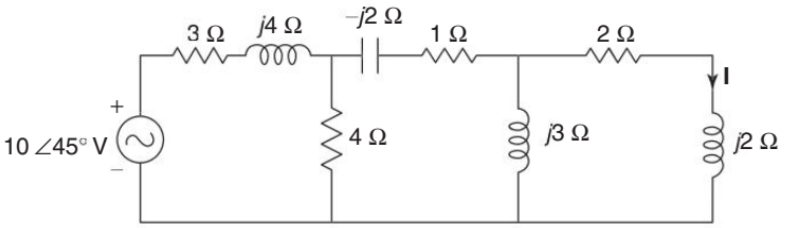

Figure 5(b)

[4 + 2 × 3 = 10 Marks]

6. a) An RLC circuit is shown in Fig. 6 (a). The magnitude of $I_i/V_i(j\omega)$ is measured and is as plotted in Fig. 6 (b) (on log-log coordinates).

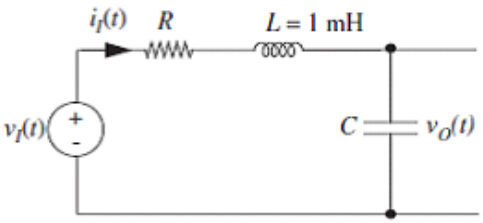

Fig. 6 (a)

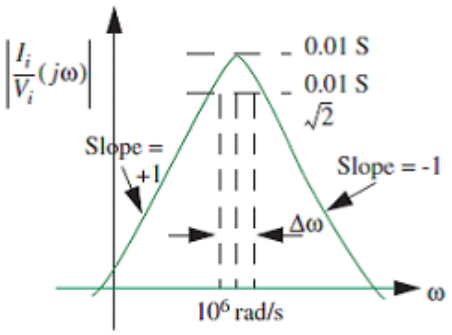

Fig. 6(b)

I. What is the value of C ?
II. What is the value of R?
III. What is the value of Δω?
IV. The circuit is now excited with a unit step of voltage. The values of $i_I(t)$ *and* $v_O(t)$ are zero prior to time $t = 0$. Sketch the signal $v_O(t)$ for $t > 0$, labelling important features.

[1+1+1+2 = 5 Marks]

b) For the circuit shown in Fig. 6(c), determine and plot v_{OUT} as a function of v_{IN}. Assume that all diodes and op amps are ideals.

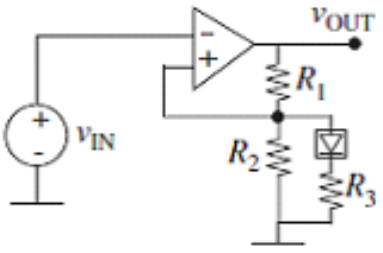

Fig. 6(c)

[5 Marks]