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Thapar University, Patiala
Electrical & Instrumentation Engineering Department

B.E. Third Year (ELE) **Dec. 10, 2016** **End Semester Test**
UEE503: NETWORK ANALYSIS AND SYNTHESIS

Time: 3.00 hrs. ; M.M.: 100

Name of Faculty: NN, GRB

Note: (i) Attempt all questions in a given sequence only.
(ii) Assume suitable data if found missing.

Q.1: **(a)** Verify the reciprocity theorem for the network shown in Fig. 1, by considering the current passes through 10 Ω resistance. **(8)**

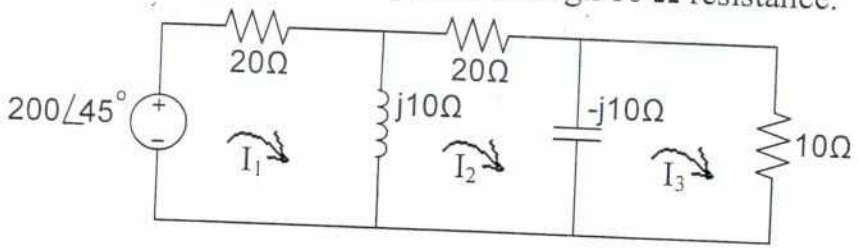

Fig. 1

(b) Verify Tellegen's theorem for the network shown in Fig. 2, where the branch voltages and current have the following values: **(8)**

$v_0 = 20,\ v_1 = 16,\ v_2 = 2,\ v_3 = 4,\ v_4 = 14,\ v_5 = 6$ (in volts)

$i_0 = -16,\ i_1 = 12,\ i_2 = 2,\ i_3 = 14,\ i_4 = 4,\ i_5 = 2$ (in amperes)

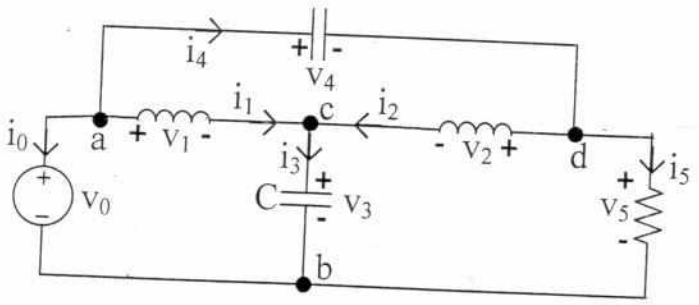

Fig. 2

Q.2: **(a)** The circuit shown in Fig. 3 is two-stage transistor amplifier. The Z-parameters for each stages, **(10)**

$$Z_1 = \begin{bmatrix} 350 & 2.667 \\ -10^6 & 6667 \end{bmatrix} \quad Z_2 = \begin{bmatrix} 1.0262\text{x}10^6 & 6{,}790.8 \\ 1.0258\text{x}10^6 & 6{,}793.5 \end{bmatrix}$$

Determine I. Input Impedance
II. Overall Voltage Gain

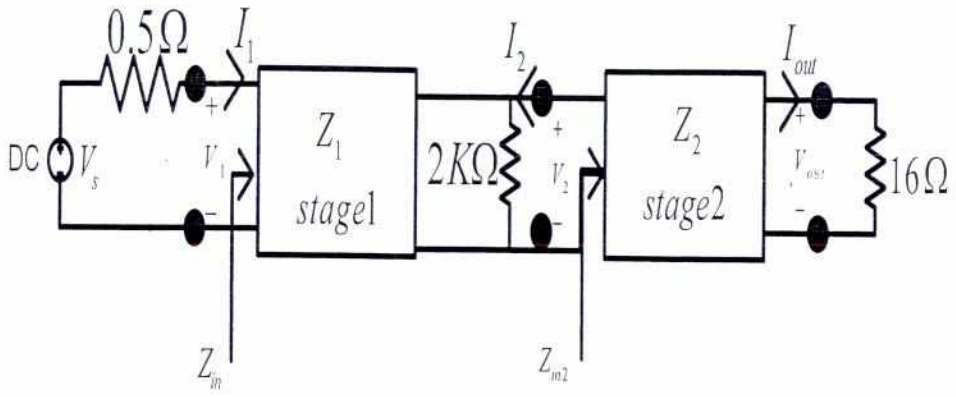

Fig. 3

(b) Derive the condition for the network to be reciprocal. Use z-parameters or Transmission parameters. **(4)**

(c) A two port network is tested to determine the short-circuit parameters. The table below shows the recorded measurements. Notations of the currents and voltages are as per standard convention followed for a Y-parameters network. **(4)**

S. No.	Port 1-1'		Port 2-2'	
	Voltage (V)	Current (mA)	Voltage (V)	Current (mA)
1	30	120	0	- 30
2	0	- 30	40	160

Determine the short-circuit parameters and draw the equivalent circuit of the two-port network.

Q.3(a): The circuit shown in Fig. 4 contains dependent sources. Calculate its voltage gains. **(10)**

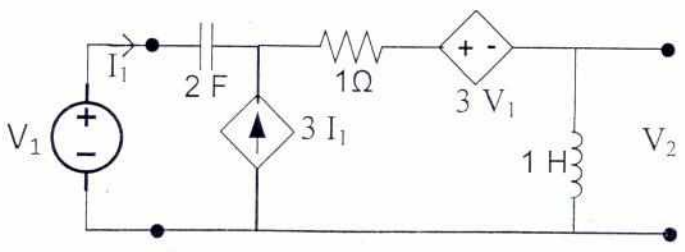

Fig. 4

3(b): For the given network as shown in Fig. 5, **(10)**

(i) Show that the input impedance at port-1 is 1-Ω with port-2 open.

(ii) Find $V_2(s)/ V_1(s)$?

All the elements of the circuit follow conventional units.

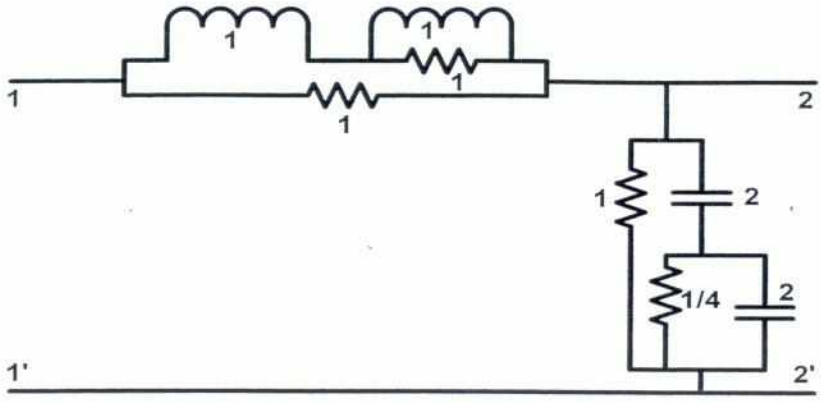

Fig. 5

Q.4(a): An inductor **L** in series with a resistor **R** of 9-Ω resistance is connected in parallel to a capacitor **C**. The driving point impedance of the parallel combination has a zero at s = -3 and two poles at s = $-1.5 \pm \frac{j1}{2}\sqrt{111}$. Calculate the value of **L** and **C.** **(8)**

4(b): Show that $\frac{I2(s)}{V1(s)} = \frac{K(s+1)}{(s+2)(s+4)}$ and find the value of 'K' in the given expression for the network shown in Fig. 6. **(10)**

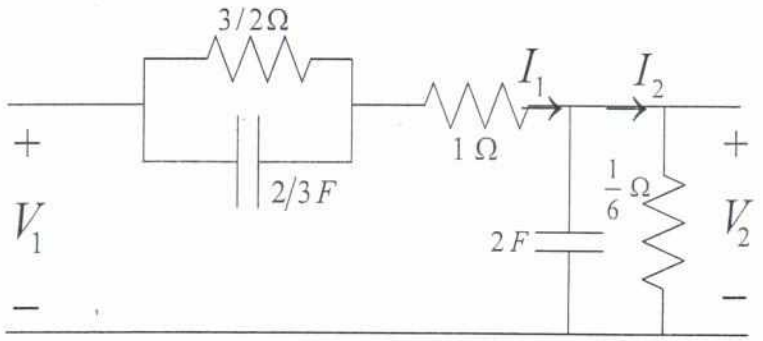

Fig. 6

Q.5(a): **(i)** Check whether the impedance function, Z(s) is of LC/RL/RC type or not? **(4)**

$$Z(s) = \frac{s^4 + 8s^2 + 15}{s^5 + 10s^3 + 24s}$$

(ii) State the necessary and sufficient conditions for the function to be positive real (PR) function. **(4)**

5(b): Synthesize the given admittance function using following methods: **(5 + 5)**

$$Y(s) = \frac{s^2 + 5s + 4}{2s^2 + 14s + 20}$$

(i) Foster Form - *I*

(ii) Foster Form – *II*

5(c): Synthesize the given impedance function using following methods: **(5 + 5)**

$$Z(s) = \frac{s\,(s+4)(s+8)}{(s+2)(s+6)}$$

(i) Cauer Form – *I*

(ii) Cauer Form – *II*

NOTE: Your answer sheets will be shown on the day Tuesday, dated: 13th of December, 2016. You are advised to visit group wise as per schedule:

- Group 1 – 3: 12:30 PM to 01:30 PM
- Group 4 – 6: 01:30 PM to 2:30 PM

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