

M.Sc. 1st Semester Examination, 2024

ELECTRONICS

(Network Analysis and Synthesis)

PAPER – ELC-103

Full Marks : 50

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate marks

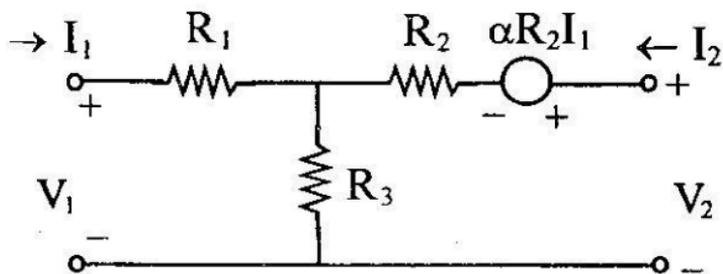
Candidates are required to give their answers in their own words as far as practicable

GROUP – A

Answer any **four** questions : 2 × 4

1. State and explain the maximum power transfer theorem.

2. Find out the Z parameters of the following network :



3. What do you mean by poles and zeros of a network functions ?
4. Inspect if the following driving point impedance function is realizable or not ?

$$Z(s) = \frac{4s^4 + s^2 - 3s + 1}{s^3 + 2s^2 + 2s + 40}$$

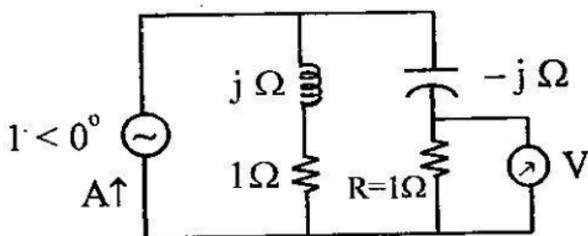
5. Suppose a function $I(s)$ has poles at $s = -1, -3$ and a zero at the origin and H is given as 5. Derive the current transform function $I(s)$.
6. State and explain the Foster's reactance theorem.

1 + 1

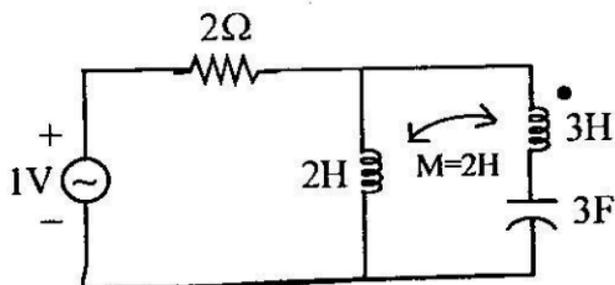
GROUP – B

Answer any **four** questions : 4×4

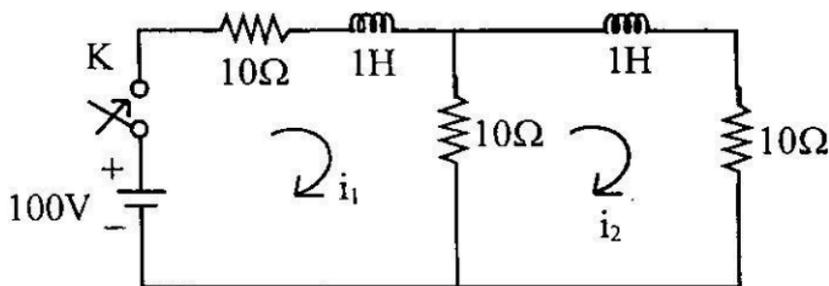
7. In the following circuit, find the reading of the voltmeter V. Interchange the current source and the voltmeter and verify the reciprocity theorem. $2 + 2$



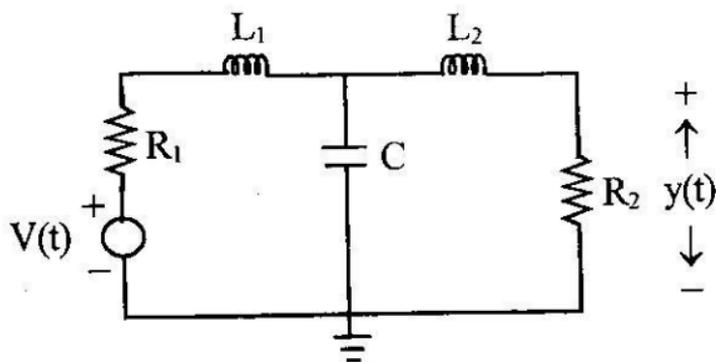
8. Draw the oriented graph of the following network. Obtain the tie-set matrix and write down the KVL equations. $2 + 1 + 1$



9. Determine the expression for the driving point impedance of a reactive network which has poles at $\omega=0$, 4000 rad/sec, and infinity. Zeros are to be located at $\omega = 2000$ and 6000 rad/sec, the impedance is to be $-j 700\Omega$ at 1000 rad/sec.
10. For a two-port network prove that $AD - BC = 1$, when the network is reciprocal.
11. Determine $i_2(t)$ of the following circuit



12. Represent the electrical circuit shown by a state model



GROUP - C

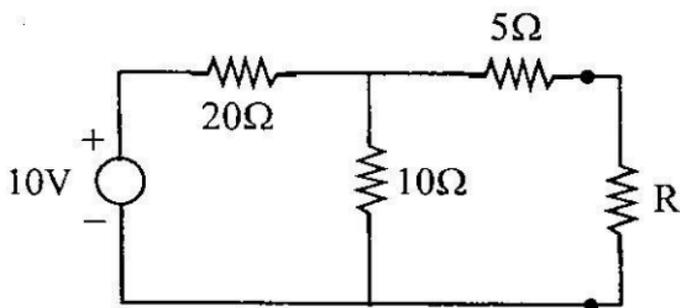
Answer any **two** questions : 8×2

13. (a) Design a constant-K high pass T-section filter with a nominal resistance of 50Ω to produce cut off at a frequency of 1.2 KHz. Find also the attenuation in dB at a frequency of 0.6 KHz.

(b) With reference to a lattice filter consisting of purely reactive elements give the physical significance of resistive value of z_0 and reactive value of z_0 .

$$(3 + 2) + \left(1\frac{1}{2} + 1\frac{1}{2}\right)$$

14. A reactance function has zeros at $\omega_1 = 10^5$ rad/sec and α . It has poles at $\omega = 0$ and $\omega_2 = 1.1 \times 10^5$ rad/sec. The slope of the reactance curve is required to be $0.1 \Omega \text{ rad}^{-1} \text{ sec}$ at $\omega = 10^5$ rad/sec. Find a reactance Network satisfying this requirement. 8
15. (a) In the following circuit, calculate the resistance R which will allow maximum power dissipation in it. Also calculate the maximum power.



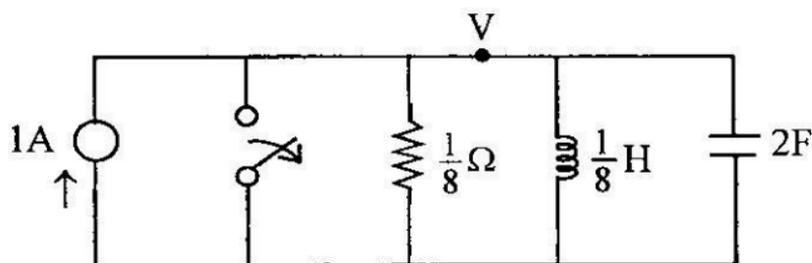
- (b) The reduced incidence matrix of an oriented graph is

$$[A] = \begin{bmatrix} 0 & -1 & 1 & 1 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Draw the graph.

4 + 4

16. (a) Find out the voltage of the following network :



- (b) Prove that the y parameters of multiple networks connected parallel to each other are summed up for the y parameters of the entire network.

4 + 4

[Internal Assessment – 10 Marks]