1 (Sem–3) ECT

2024

ELECTRONICS AND COMMUNICATION TECHNOLOGY

Paper : ECT0300104

(Network Analysis)

Full Marks : 45

Time : 2 hours

The figures in the margin indicate full marks for the questions.

1. Fill in the blanks : 1×5=5

   (a) A series network of resistors used for providing different voltages from a single voltage source is called _____ .

   (b) A filter allows a particular frequency range to pass which is known as _____ band.

   (c) The total resistance of a parallel circuit is always _____ than the lowest resistance connected in any of its branches.

(d) A balanced form of π-section is also known as _____ section.

(e) If $f(t) = 1$, then $F(s) =$ _____ .

2. Answer ***any five*** from the following questions : 2×5=10

(a) State Superposition Theorem.

(b) Define Ideal constant voltage source and Ideal constant current source.

(c) Draw a low-pass prototype filter (both T-section and π-section).

(d) Write the mathematical expression for Laplace Transform and Inverse Laplace Transform.

(e) In an RC-type low-pass filter, $R = 550\Omega$ and $f_c = 400Hz$. Determine the value of C.

(f) What do you mean by Tree and Twigs in Network Theory ?

(g) Define node and branch of a network.

(h) Determine the Laplace transform of an exponential function.

(i) Draw the block diagram of a two-port network.

(j) What are transfer Impedance and Admittance ?

3. Answer ***any four*** of the following questions : 5×4=20

(a) State and explain voltage division rule.

(b) Transform the circuit from delta to Y:

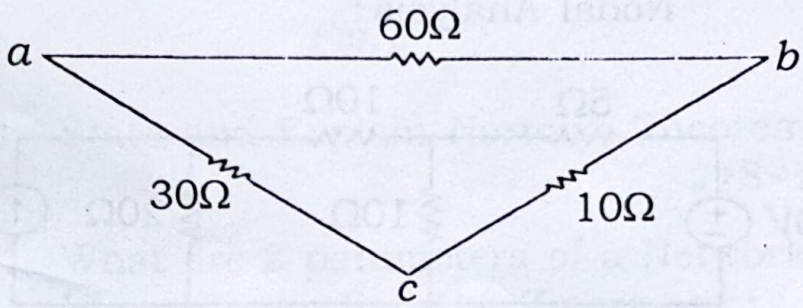

Fig. 1

(c) What are poles and zeros in a network function ? Determine the poles and zeros of the transfer function given by

$$Z(s) = \frac{2(s+2)(s+4)}{(s+3)(s+5)(s+7)}.$$

(d) Derive the Step response of RL circuit using Laplace transform.

(e) Explain briefly the different types of graphs in network theory.

(f) Find the Laplace transform of a derivative $\left[\frac{df(t)}{dt}\right]$.

(g) Determine the current through 20Ω resistor in the following circuit using Nodal Analysis :

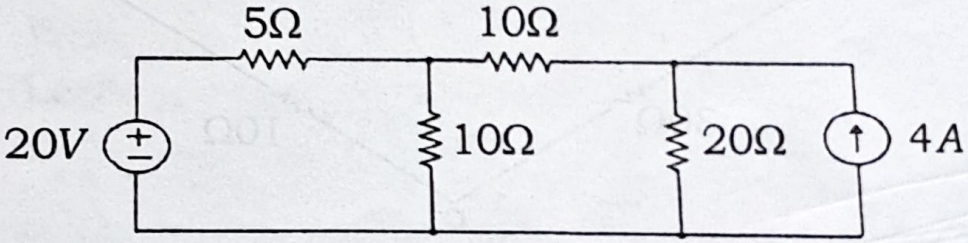

Fig. 2

(h) State and explain Reciprocity Theorem.

4. Answer ***any one*** of the following questions : 10

(a) What is Filter? Describe different types of Passive types of passive filters with proper diagrams. 2+8=10

(b) State Thevenin's theorem. Apply Thevenin's theorem to find the current through load resistor R_L of the circuit given below. Here $V_S = 20V$, $R_1 = 10\Omega$, $R_2 = 10\Omega$, $R_3 = 5\Omega$ and $R_L = 100\Omega$. 2+8=10

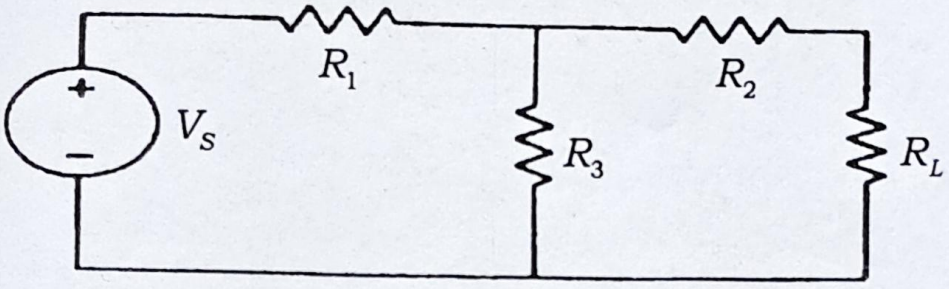

Fig. 3

(c) State and Explain Norton's Theorem. 2+8=10

(d) What are Z parameters of a Network? How will you find the Z parameters of the following two-port Network.

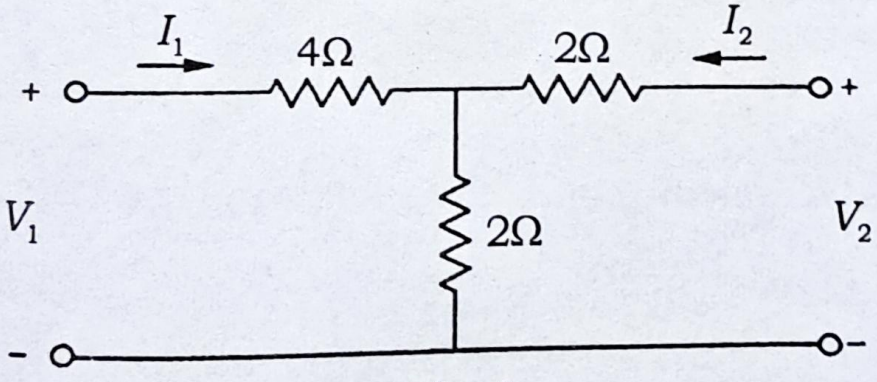

Fig. 4