Printed Pages—6   TEE—402

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2052   Roll No. ☐☐☐☐☐☐☐☐☐☐

B.Tech.

FOURTH SEMESTER EXAMINATION, 2005-2006

NETWORK ANALYSIS AND SYNTHESIS

*Time : 3 Hours*   *Total Marks : 100*

Note :   *(i)*   *Attempt **ALL** questions.*

     (ii)   *All questions carry equal marks.*

     (iii)   *In case of numerical problems assume data wherever not provided.*

     (iv)   *Be precise in your answer.*

1.   Attempt *any three* parts of the following : $(6\frac{2}{3}\times3=20)$

     (a)   Differentiate the terms "Cut-set" and "Tie-set" related to a linear graph.

        Write the properties of incidence matrix and also obtain the incidence matrix of the graph shown in fig 1(a)

Fig 1(a)
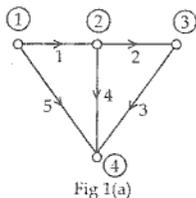
(b) In graph theory, derive the relation among submatrices of A, B and Q, where A, B and Q have their usual meanings.

(c) A resistive network is shown in fig 1(c), write corresponding tie-set matrix and obtain KVL equation using graph theory.
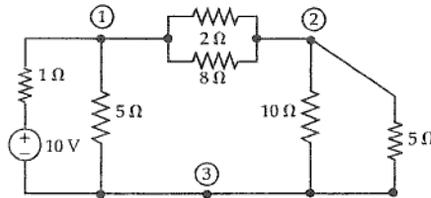

Fig. 1(c)

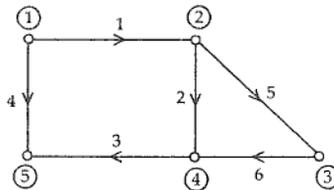(d) Show the cut-sets for the graph of the network shown in fig 1(d) and develop the fundamental cut-set matrix.

Fig. 1(d)

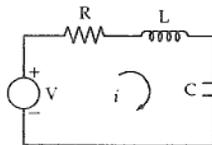(e) Prove that given circuits shown in fig 1(e) (i) and 1e(ii) are duals of each other. Use graph theory only.
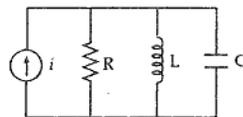

Fig. 1(e)(i)   Fig. 1(e)(ii)

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2. Attempt *any three* parts of the following : $(6\frac{2}{3}\times3=20)$

(a) In the network shown in fig 2(a), find the current through capacitor using principle of superposition.
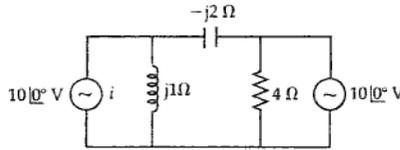

Fig. 2 (a)

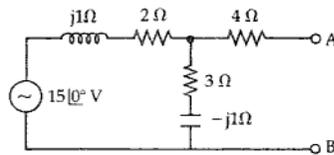(b) Find the Thevenin's equivalent circuit for the network given in fig 2(b) across A and B.

Fig. 2 (b)

(c) In the network shown in fig 2(c), find the value of R_L which results in maximum power transfer. Also find maximum power.
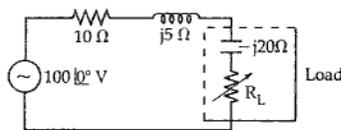

Fig. 2 (c)

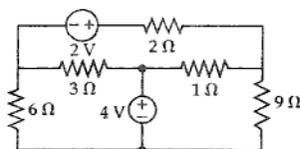(d) State the Tellegen's theorem and verify it for the network shown in fig 2(d).

Fig. 2 (d)

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(e) Verify Reciprocity theorem of the network shown in fig 2 (e) and find V_x.
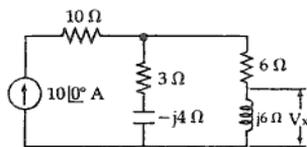

Fig. 2 (e)

3. Attempt *any two* parts of the following :   (10x2=20)

(a) Enlist the necessary conditions for transfer function in terms of pole and zero locations. Draw the pole-zero diagram of the given function and obtain time domain response using if.

$$I(S) = \frac{2S}{(S+1)(S^2 + 2S + 4)}$$

(b) (i) Using Routh - Hurwitz criterion, check the stability of the following polynomials.

$$P(S) = S^6 + S^5 + 3S^4 + 3S^3 + 3S^2 + 2S + 1$$

(ii) $P(S) = S^4 + 20KS^3 + 5S^2 + 10S + 15 = 0$

is a characteristic equation of control system. Find the range of K for the system to be stable.

(c) Draw the Bode plot of the following transfer function having unity feedback.

$$G(S) = \frac{50}{S(1+S)(5+S)(10+S)}$$

Find gain cross over and phase cross-over frequency.

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4. Attempt *any two* parts of the following :   (10x2=20)

(a) Find Y-parameters of the network shown in fig 4(a) and check whether the circuit is symmetric and reciprocal or not.
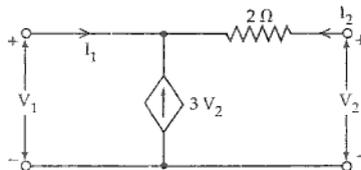

Fig. 4(a)

Also hence find h-parameters of the network.

(b) A 2-port network made up of passive linear resistors is fed at port 1 by an ideal voltage source of V volts. It is loaded at port 2 by a resistance R:

(i) With $V = 10$ volts and $R = 6\Omega$, currents at ports 1 and 2 were 1.44 A and 0.2A respectively.

(ii) With $V = 15$ volt and $R = 8\Omega$, the current at port 2 was 0.25 A. Determine π equivalent circuit of 2-port network.

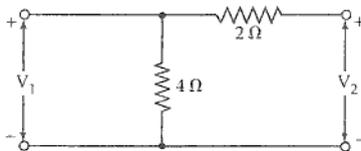(c) For the two part network shown in fig 4(c), find h parameters and hence find ABCD parameters.

Fig. 4(c)

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5. Attempt *any three* parts of the following : $(6\frac{2}{3} \times 3 = 20)$

    (a) Enlist the properties of an LC immittance driving point function. Obtain the driving point impedance in Laplace form of the given network across a-b shown in fig 5(a).
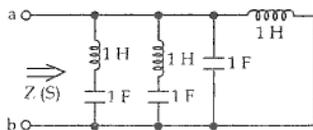

Fig. 5 (a)

    (b) An impedance function is given by

    $$Z(S) = \frac{2(S+1)(S+3)}{(S+2)(S+4)}$$

    Find the R-L representation of Foster first form.

    (c) List and explain the properties of a passive filter.

    (d) A T-section low pass filter has series inductance 80 mH and shunt capacitance 0.022 μF. Determine the cut-off frequency and nominal design impedance. Also design an equivalent π-section.

    (e) A series LCR type band-stop filter has R = 1.5 kΩ; L = 140 mH and C = 300 pf. Find the

        (i)   Resonant frequency and

        (ii) Bandwidth. Also find the cut-off frequencies.

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