Faculty of Engineering & Technology

Third Semester B.E. (Electronics Engg./ET/EC)

(C.B.S.) Examination

NETWORK ANALYSIS & SYNTHESIS

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Assume suitable data wherever necessary.

(3) Illustrate your answers wherever necessary with the help of neat sketches.

(4) Use of non-programmable calculator is permitted.

1. (a) Convert the combination shown in Fig. 1(a) to a single source in parallel with a single element. 6

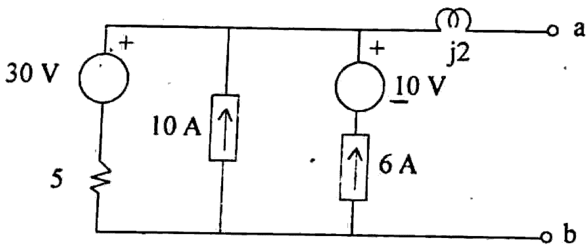

Fig. 1(a)

(b) Write mesh equations in matrix form for the network shown in 'Fig. 1(b)'. 7

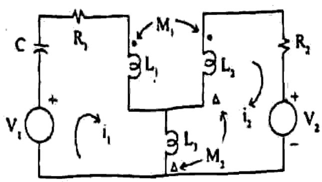

Fig. 1(b)

OR

2. (a) Determine 'I_L' of 'Fig. 2(a)' using NODAL ANALYSIS. 7

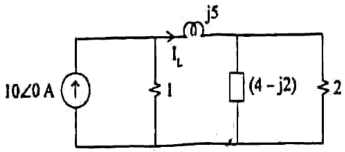

Fig. 2(a)

(b) Draw the dual of the network shown in 'Fig. 2(b)'. 6

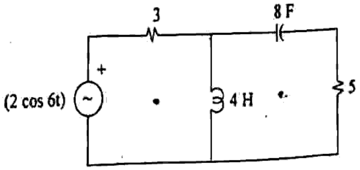

Fig. 2(b)

3. (a) Find the change in current I if the 4 Ω resistor is changed to 3 Ω resistor of 'Fig. 3(a)' by using COMPENSATION THEOREM. 7

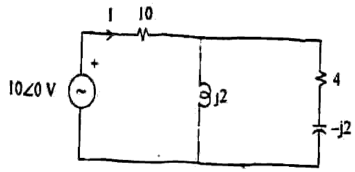

Fig. 3(a)

(b) Verify RECIPROCITY THEOREM for the circuit shown in 'Fig. 3(b)'. 7

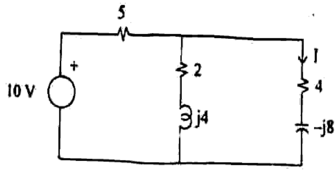

Fig. 3(b)

OR

4. (a) For the circuit shown in 'Fig. 4(a)' :

(i) Find Thevenin's and Norton's equivalent between a and b,

(ii) If $Z_L = (8.45 + j0.415)\Omega$ is connected between a and b, find I_L using THEVENIN'S THEOREM.

(iii) Find Z_L between a and b for maximum power transfer,

(iv) Find the value of maximum power. 9

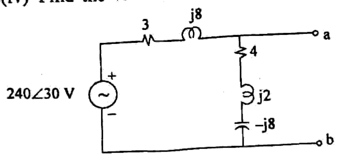

Fig. 4(a)

(b) Determine current in the capacitor branch by SUPERPOSITION THEOREM in the circuit of 'Fig. 4(b)'. 5

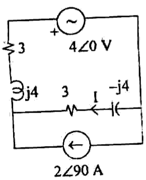

Fig. 4(b)

5. (a) A coil having a resistance of 50 Ω and an inductance of 10 mH is connected in series with capacitor. This series combination is supplied by constant voltage and variable frequency source. The maximum current is 1A at 750 Hz. Determine bandwidth and half power frequency. 7

(b) A series R-L-C network is excited by a variable frequency sinusoidal voltage source. Draw the variation of total impedance (Z), inductive reactance (X_L), capacitive reactance (X_C), total reactance (X) and total current (I) with respect to frequency and mark fr. 6

OR

6. (a) A series RLC circuit has R = 25 Ω, L = 0.4 H and C = 0.01 μF. Calculate the resonant frequency. If a 1 volt source of same frequency as the resonant frequency is applied to the circuit, calculate the frequencies at which the voltage across L and C are maximum. 7

(b) Compare series and parallel resonance in a.c. circuit. 6

7. (a) Find the component values of T and π-network constant-K HPF having cut-off frequency of 8 kHz and nominal characteristics impedance of 600 Ω. Hence find its characteristic impedance for T and π-network and phase constant at F = 12 kHz and attenuation at f = 0.8 kHz. 8

(b) Design a balanced and symmetrical π-attenuator to give 15 decibel loss. The characteristic impedance of attenuator is 600 Ω. Draw the network designed. 6

OR

8. (a) Design a constant-K band pass filter with cut-off frequencies of 3 kHz and 7.5 kHz with nominal characteristics impedance of 900 Ω. 8

(b) Design and draw a symmetrical lattice attenuator to have characteristic impedance of 500 Ω and attenuation of 20 db. 6

9. (a) In the circuit shown in 'Fig. 9(a)', the switch-K is moved from position-1 to position-2 at t = 0, a steady state having previously been established at position-1. Solve for current i(t). 7

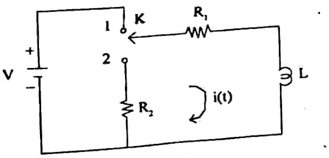

Fig. 9(a)

(b) Find an expression for the impulse response of series RC network using LAPLACE TRANSFORM. 6

OR

(Contd.)

10. (a) Write the equations of the waveform shown in 'Fig. 10(a)' and find its Laplace Transform. 7

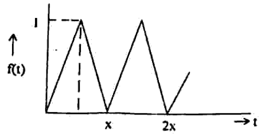

Fig. 10(a)

(b) Determine the voltage across capacitor by LAPLACE TRANSFORM of 'Fig. 10(b)'. At t = 0, switch-K is closed. Assume initial voltage across capacitor is 2 V. 6

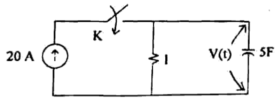

Fig. 10(b)

11. (a) Obtain OPEN CIRCUIT PARAMETERS of the network shown in 'Fig. 11(a)'. Check RECIPROCITY CONDITION of the network. 4

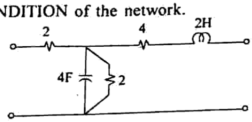

Fig. 11(a)

(Contd.)

(b) In the two port network shown in Fig. 11(b), find h-parameters from the following data :

(i) With the output port is short circuited :

$V_1 = 25$ V; $I_1 = 1$A, $I_2 = 2$A

(ii) With the input port is open circuited :

$V_1 = 10$ V, $V_2 = 50$ V, $I_2 = 2$A.

Hence find open circuit parameters. 5

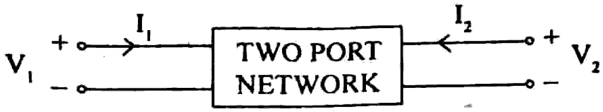

Fig. 11(b)

(c) Express Y parameters in terms of ABCD parameter. 4

OR

12. (a) Find voltage ratio $\frac{V_o(s)}{V_i(s)}$ for ladder network shown in 'Fig. 12(a)'. 7

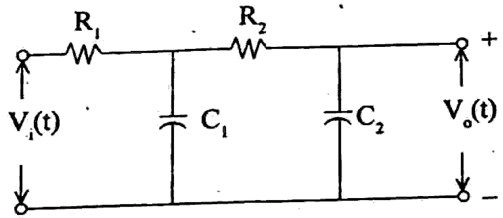

Fig. 12(a)

(b) Plot poles and zeros in s-plane and from POLE-ZERO DIAGRAM, find i(t) if :

$$I(s) = \frac{4s}{s^2 + 2s + 2}.$$ 6