BHARATI VIDYAPEETH'S COLLEGE OF ENGINEERING, DELHI

[Network Analysis & Synthesis]

[Question Bank]

BY

Parashuram

[23-05-2024]

Q1. Sketch the following signals.

(I) $t^2\left[u(t-1)-u(t-3)\right]$

(II) $5u(t+2)+10u(t-4)-20u(t-6)$

(III) $u(t)+\sum_{k=-1}^{\infty}(-1)^K 3u(t-k)$

Q2. What do you mean by network analysis and synthesis?

Q3. What is unit step function? What is its relationship with unit impulse function?

Q4. Make symbols of ideal dependent current source, ideal dependent voltage source, ideal independent current source and ideal independent voltage source.

Q5. Write the equation of currents and voltages across inductor and capacitor with respect to time 't".

Q6. Define unit step function, unit ramp function, unit impulse function and unit doublet Function?

Q7. A step voltage of 10V is applied at t=0 in a series RC circuit where R=10 ohms and C=2F.The initial charge on the capacitor is nil. Find i(t).

Q8. What do poles and zeros signify?

Q9. Determine the voltage across a 2-μF capacitor if the current through it is $i(t)=6e^{-3000t}\,\text{mA}$ .Assume that the initial capacitor voltage is zero. Also draw the current wave form.

Q10. The current through a 0.1-H inductor is $\boldsymbol{i(t) = 10te^{-5t}}$ **A**. Find the voltage across the inductor and the energy stored in it. [**Hint:** Energy stored in Inductor $=\int P(t)dt=\int v(t).i(t)dt$]

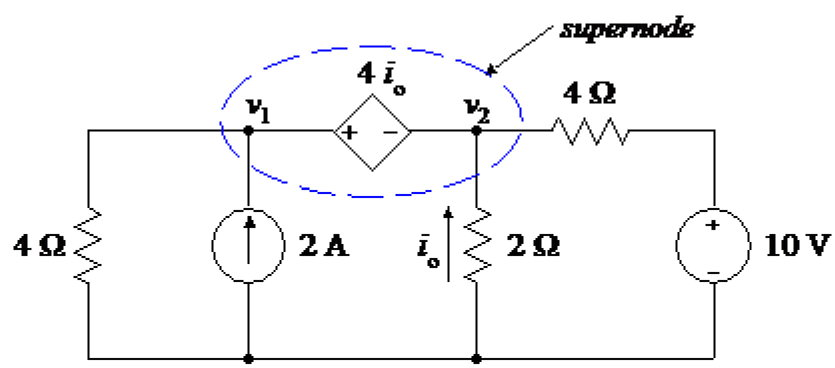
Q11. (I) if $f(t)=e^{j\omega t}$ then find $\int_{-\infty}^{+\infty} e^{j\omega t}\ \delta(t-T)dt$, and (II) if $f(t)=\sin t$ then find $\int_{-\infty}^{+\infty}\sin t\ \delta(t-\frac{\pi}{4})dt$

Q12. Define electrical circuit. Write the examples of active and passive elements.

Q13. Describe initial and final value condition of Inductor and capacitor.

Q14. In the circuit of Figure 1, find the current i_o using nodal analysis.

Figure 1

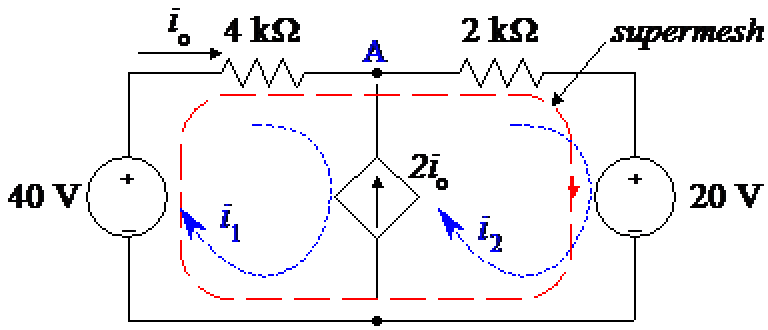


Q15. In the circuit of Figure 2,

(a) Find the current i_o using mesh analysis.

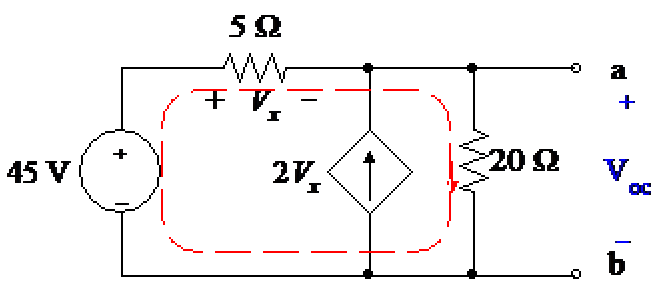
(b) Find the power supplied by the dependent current source.

Figure 2



Q16. Obtain the Thevenin equivalent of the circuit in Figure 3 with respect to the terminals a-b.

Figure 3.

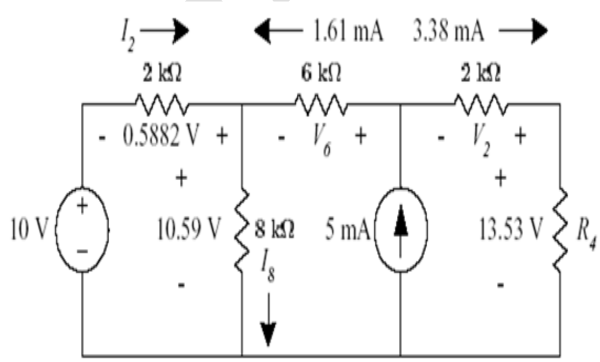


.

Q17. State Norton's theorem and give steps to develop Norton's equivalent circuit from Thevenin's theorem.

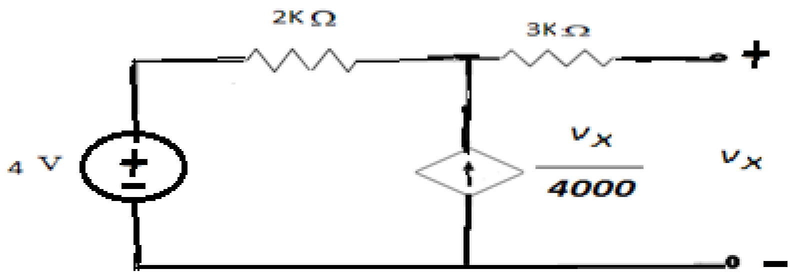
Q18. State and explain Thevenin's theorem.

Q19. For the given network find out the values of I_2, V_6, R_4, V_2 and I_8.

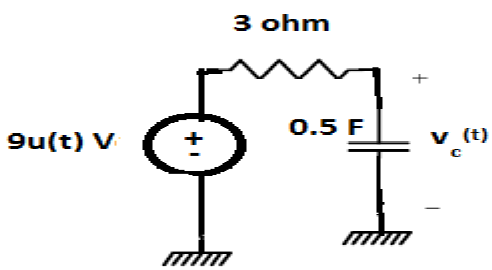


Q20. Describe the network elements and the transformed circuit.

Q21. Determine the Thevenin's equivalent of the circuit shown in Fig.



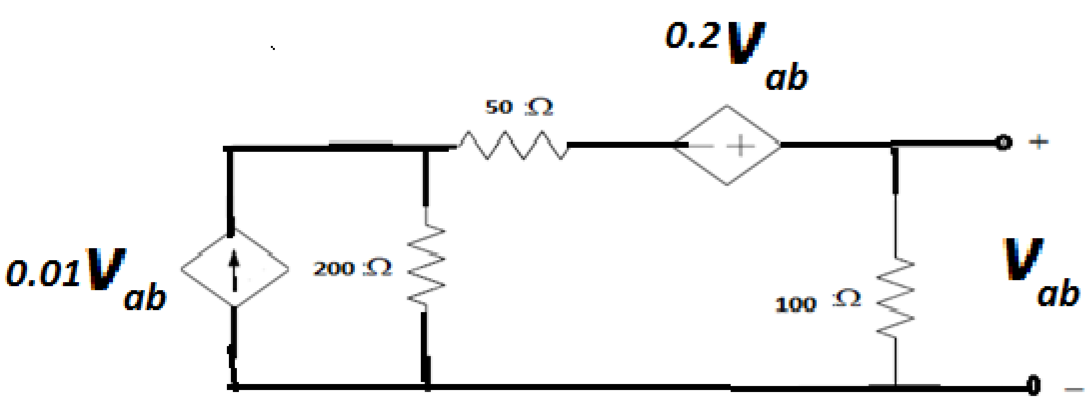
Q22. Determine $v_c(t)$ in the circuit of the figure. Given an initial voltage $v_c(0^-) = -2V$.



Q23. (I). What is significance of poles and zeros (OR) Classify the response based on location of poles and zeros? **(II).** Using graphical method, find the time domain response if the voltage wave form is given by $V(s) = \dfrac{4s}{(s+2)(s^2+2s+2)}$

Q24. Find the partial fraction expansion for $F(s) = \dfrac{s^3+4s^2+7s+5}{s^2(s^2+2s+5)}$ and find Laplace inverse.

Q25. Find the Thevenin's and Norton's equivalents of the circuits shown in Fig.

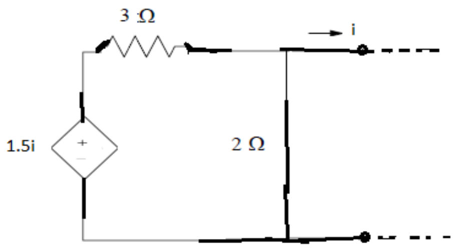


Q.26. Define poles and zeros.

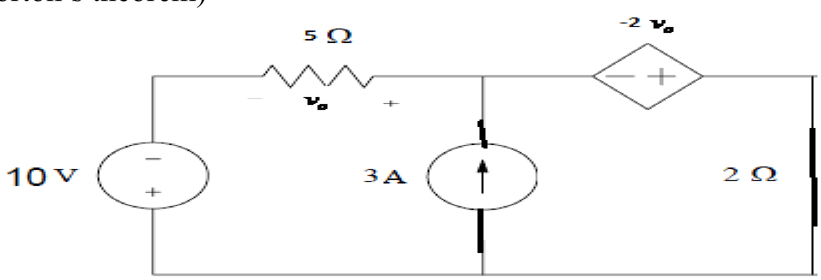
Q.27. Derive the frequency shifting (complex translation) and time shifting (Real Translation) properties of Laplace transform.

Q.28. State the real differentiation properties of Laplace Transform

Q.29. Determine the Thevenin equivalent of the circuit shown in Fig.

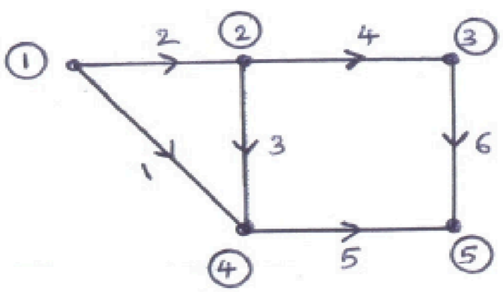


Q30. Write the statements of Thevenin's and Norton's theorem and also write the limitations.
Q31. Find the current in 2 Ohm resistance resistance in the network shown in Fig. (I). (using Norton's theorem)



(I)

Q32. Write the complete and reduced incidence matrix for given graph a network.



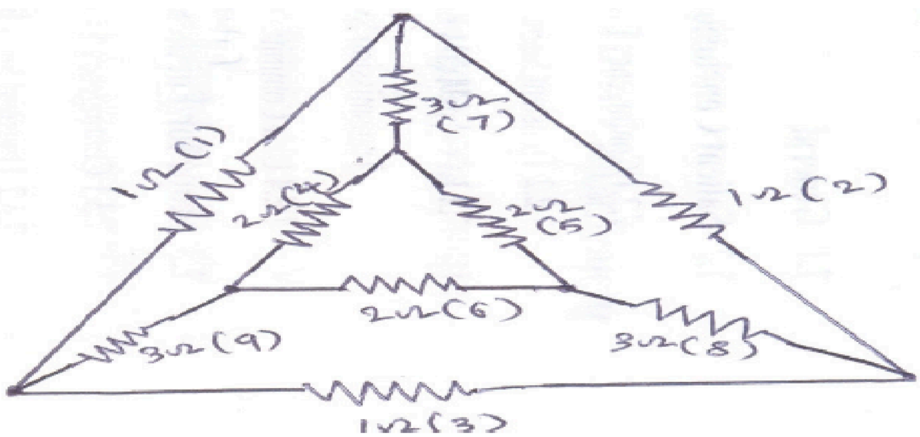
Q33. Define the basic elements of network topology
Q34. Draw the oriented graph of incidence matrix shown below

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

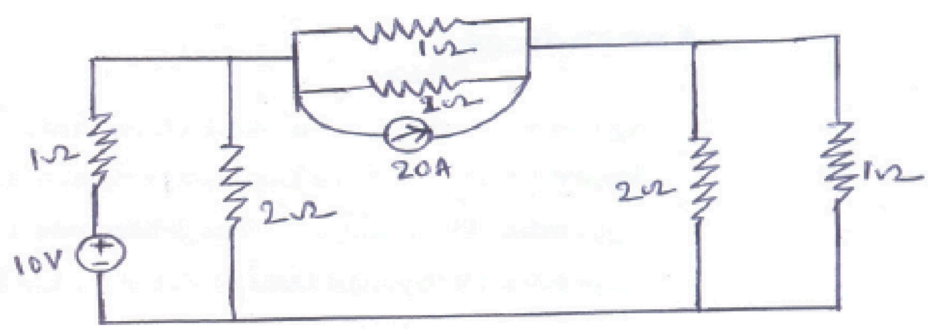
Q35. Draw the oriented graph of incidence matrix shown below

$$A_a = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & -1 \\ -1 & 1 & 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & -1 & 0 & 1 \\ 0 & 0 & -1 & 1 & -1 & 0 \end{bmatrix}$$

Q36. Show that determinant of the incidence matrix of a closed loop is zero.
Q37. (a) For the given network shown. Draw the graph, select a tree with branches 9, 4, 7, 5, & 8 and write the tie-set matrix. The number inside the brackets indicates branch numbers.
(b) Using the above tie-set matrix formulate equilibrium equations.



Q38. Draw the graph for the network shown in figure below. Write the cut-set schedule & obtain equilibrium equations and hence calculate values of branch voltages and branch currents



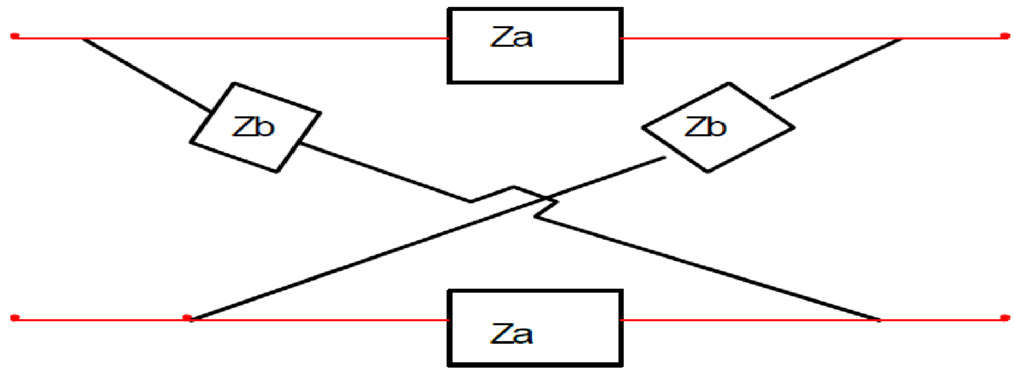
Q.39. Write basic equations representing transmission parameters.

Q.40. Which parameters are preferred for cascade connected networks and why?

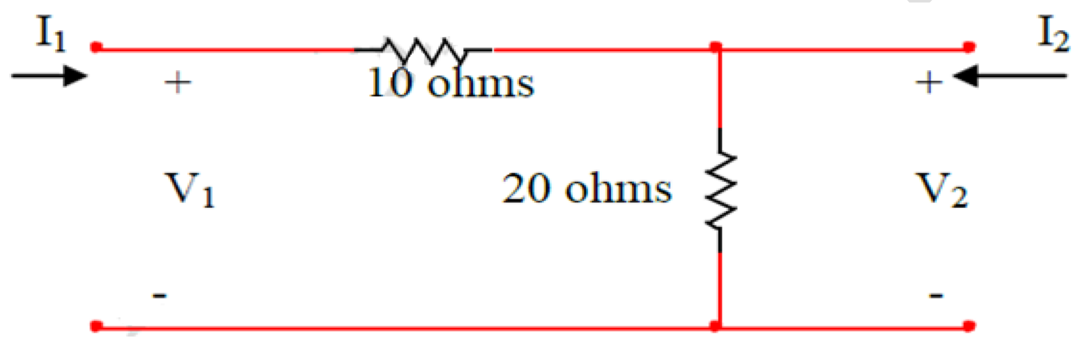
Q.41. In terms of ABCD parameters when is a two-port network symmetrical?

Q.42. Give the difference between the Transmission and Inverse Transmission Parameters for reciprocity and symmetry.

Q.43. The open- circuit transfer impedance Z21 of the two-port network is



Q.44. Find the h parameters of the circuit shown in figure.



Q.45. Give the internal block diagram of op-amp and mention the role of each stage. Give the pin-diagram of IC 741 and illustrate the concept of virtual ground.

Q.46. Summarize the frequency expressions for LPF, HPF and BPF.

Q.47. Enumerate the advantages & disadvantages of passive filters?

Q.48. What do you understand by filters? Give its classification.

Q.49. Discuss with necessary theory, the working of a second order high pass filter.

Q.50. State the advantages of active filters.

Q.51. Draw the first order low pass Butterworth filter and obtain its frequency response.

Q.52. Draw the first order high pass Butterworth filter and obtain its frequency response.

Q.53. An impedance function is given by $Z(s)=\frac{K(s^2+1)(s^2+9)}{s(s^2+4)}$. If $Z(-2)=\frac{-130}{16}$, synthesize the impedance in ***FOSTER-II and CAUER-I form.***

Q.54. An impedance function is given by $Z(s)=\frac{K(s^2+1)(s^2+9)}{s(s^2+4)}$. If $Z(-2)=\frac{-130}{16}$, synthesize the impedance in ***FOSTER-I and CAUER-II form.***

Q.55. Check whether the given functions are positive real function or not??

(I). $F(s) = \frac{2s^2 + 2s + 1}{s^3 + 2s^2 + s + 2}$

(II). $F(s) = \frac{s^3 + s^2 + 3s + 5}{s^2 + 6s + 8}$

(II). $F(s) = \frac{(s+2)(s+4)}{(s+1)(s+3)}$

Q.56. Define Hurwitz polynomial and Write its properties**.**

Q.57. Define positive realness (p.r.f.) and Write the properties of Positive real function (p.r.f.)

Q.58. Write the properties of L-C immittance functions.

Q.59. Write the properties of R-C impedance or R-L admittance functions.

Q.60. Write the properties of R-L impedance or R-C admittance functions.

Q.61. Check whether the given functions are positive real function or not??

(I). $F(s) = \frac{2s^2 + 2s + 1}{s^3 + 2s^2 + s + 2}$

(II). $F(s) = \frac{s^3 + s^2 + 3s + 5}{s^2 + 6s + 8}$

(II). $F(s) = \frac{(s+2)(s+4)}{(s+1)(s+3)}$

Q.62. Check whether the given functions are positive real function or not??

(I). $Z(s) = \frac{as^2 + b}{s}$

(II). $Z(s) = s + 3$

(III). $Z(s) = s + j$

(IV). $Z(s) = s^2 + 1$

(V). $Z(s) = \frac{s^2 + 1}{s^3}$

(VI). $Z(s) = s^{0.8}$

(VII). $Z(s) = s - 4$

Q.63. What do we mean by Network synthesis? How is it different from network analysis?

Q.64. Write necessary and sufficient conditions for a function to be positive real **(OR)** Write ***the necessary and sufficient*** condition of positive real function (p.r.f.)

Q.65. Find the R-L network corresponding to the driving point impedance using Cauer form I and Cauer form II.

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

Q.66. Find the R-C network corresponding to the driving point impedance using Cauer form I and Cauer form II.

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

Q.67. Find the R-L network corresponding to the driving point impedance using ***FOSTER-I*** and ***FOSTER-II*** . $Z(S)=\frac{(s+4)(s+8)}{(s+2)(s+6)}$

Q.68. Find the R-C network corresponding to the driving point impedance using ***FOSTER-I*** and ***FOSTER-II*** . $Z(S)=\frac{(s+4)(s+8)}{(s+2)(s+6)}$

Q.69. An impedance function is given by $Z(s)=\frac{s(s^2+4)}{2(s^2+1)(s^2+9)}$. Synthesize the impedance in ***FOSTER-II and CAUER-I form.***

Q.70. An impedance function is given by $Z(s)=\frac{s(s^2+4)}{2(s^2+1)(s^2+9)}$. Synthesize the impedance in ***FOSTER-I and CAUER-II form.***

Q.71. An admittance function is given by $Y(s)=\frac{4S^2+6S}{S+1}$. Realize the network using Cauer's first and second forms.

Q.72. Check whether the given polynomials are Hurwitz or not?

(I). $F(s)=s^4+s^3+5s^2+3s+4$

(II). $F(s)=s^5+7s^4+6s^3+9s^2+8s$

(II). $F(s)=s^4+s^3+2s^2+4s+1$

Q.73. What is a transfer function? Write necessary conditions for transfer functions.

Q.74. What is driving point impedance? List four important properties of a driving point impedance function of an RC network.

Q.75. Write the properties of transfer function.

Q.76. Write the properties of open circuit parameters.

Q.77. Write the properties of short circuit parameters.

Q.78. What is a zero of transmission?

Q.79. Find zeros of transmission for following cases:

(I). L-C parallel combination in series arm

(II). L-C Series combination in shunt arm

(III). R-C parallel combination in series arm

Q.80. Find zeros of transmission for following cases:

(I). R-C Series combination in shunt arm

(II). R-L Series combination in parallel arm

(III). R-L parallel combination in series arm