CHAPTER

1.8

CIRCUIT ANALYSIS IN THE S-DOMAIN

1. $Z(s) = ?$

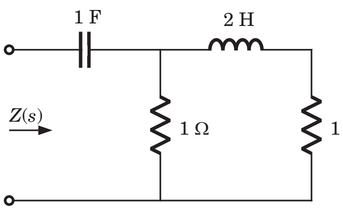


Fig. P1.8.1

(A) $\frac{s^2 + 1.5s + 1}{s(s+1)}$ (B) $\frac{s^2 + 3s + 1}{s(s+1)}$

(C) $\frac{2s^2 + 3s + 2}{s(s+1)}$ (D) $\frac{2s^2 + 3s + 1}{2s(s+1)}$

2. $Z(s) = ?$

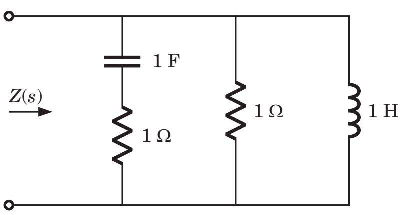


Fig. P1.8.2

(A) $\frac{s^2 + s + 1}{s(s+1)}$ (B) $\frac{2s^2 + s + 1}{s(s+1)}$

(C) $\frac{s(s+1)}{2s^2 + s + 1}$ (D) $\frac{s(s+1)}{s^2 + s + 1}$

3. $Z(s) = ?$

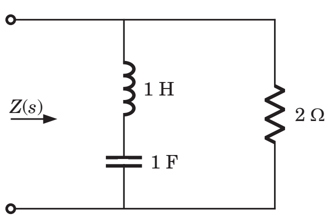


Fig. P1.8.3

(A) $\frac{s^2 + 1}{s^2 + 2s + 1}$ (B) $\frac{2(s^2 + 1)}{(s+1)^2}$

(C) $\frac{2s^2 + 1}{s^2 + 2s + 2}$ (D) $\frac{s^2 + 1}{3s + 2}$

4. $Z(s) = ?$

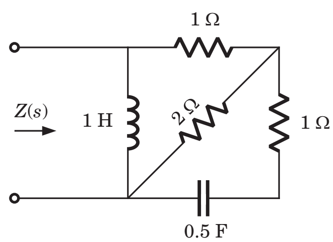


Fig. P1.8.4

(A) $\frac{3s^2 + 8s + 7}{s(5s + 6)}$ (B) $\frac{s(5s + 6)}{3s^2 + 8s + 7}$

(C) $\frac{3s^2 + 7s + 6}{s(5s + 6)}$ (D) $\frac{s(5s + 6)}{3s^2 + 7s + 6}$

5. The *s*-domain equivalent of the circuit of Fig.P1.8.5. is

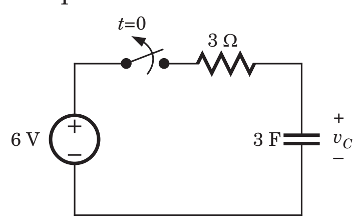
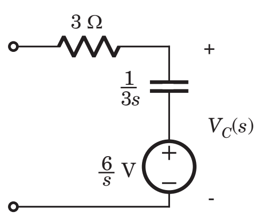
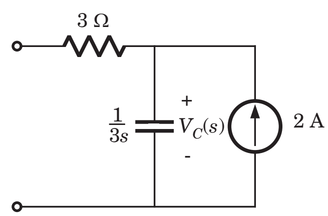


Fig. P1.8.5



(A)



(B)

(C) Both A and B (D) None of these

6. The s–domain equivalent of the circuit shown in Fig. P1.8.6 is

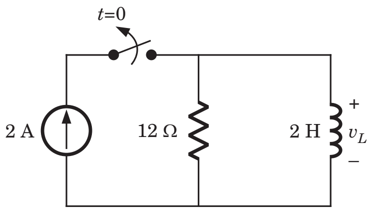
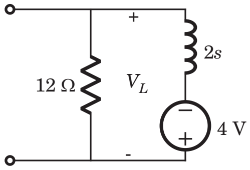
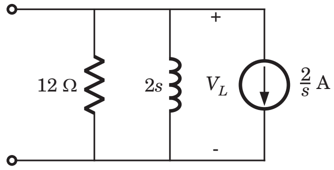


Fig. P1.8.6

(A)



(B)



(C) Both A and B

(D) None of these

Statement for Q.7-8:

The circuit is as shown in fig. P1.8.7–8. Solve the problem and choose correct option.

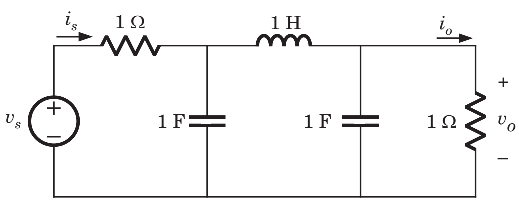


Fig. P1.8.7–8

7. $H_1(s) = \dfrac{V_o(s)}{V_s(s)} = ?$

(A) $s(s^3 + 2s^2 + 3s + 1)^{-1}$

(B) $(s^3 + 3s^2 + 2s + 1)^{-1}$

(C) $(s^3 + 2s^2 + 3s + 2)^{-1}$

(D) $s(s^3 + 3s^2 + 2s^2 + 2)^{-1}$

8. $H_2(s) = \dfrac{I_o(s)}{V_s(s)} = ?$

(A) $\dfrac{-s}{(s^3 + 3s^2 + 2s + 1)}$

(B) $-(s^3 + 3s^2 + 2s + 1)^{-1}$

(C) $\dfrac{-s}{(s^3 + 2s^2 + 3s + 1)}$

(D) $(s^3 + 2s^2 + 3s + 2)^{-1}$

9. For the network shown in fig. P1.8.9 voltage ratio transfer function G_{12} is

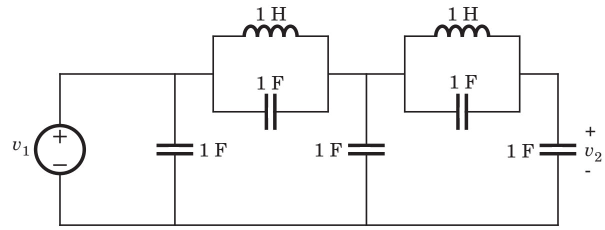


Fig. P1.8.9

(A) $\dfrac{(s^2 + 2)}{5s^4 + 5s^2 + 1}$

(B) $\dfrac{s^2 + 1}{5s^4 + 5s^2 + 1}$

(C) $\dfrac{(s^2 + 2)^2}{5s^4 + 5s^2 + 1}$

(D) $\dfrac{(s^2 + 1)^2}{5s^4 + 5s^2 + 1}$

10. For the network shown in fig. P1.8.10, the admittance transfer function is

$$Y_{12} = \frac{K(s+1)}{(s+2)(s+4)}$$

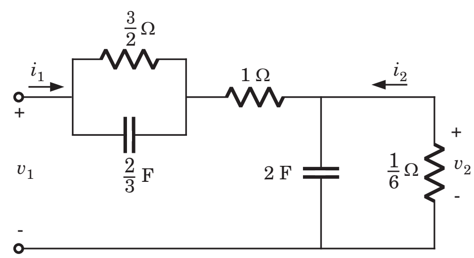


Fig. P1.8.10

The value of K is

(A) –3

(B) 3

(C) $\dfrac{1}{3}$

(D) $-\dfrac{1}{3}$

11. In the circuit of fig. P1.8.11 the switch is in position 1 for a long time and thrown to position 2 at $t = 0$. The equation for the loop currents $I_1(s)$ and $I_2(s)$ are

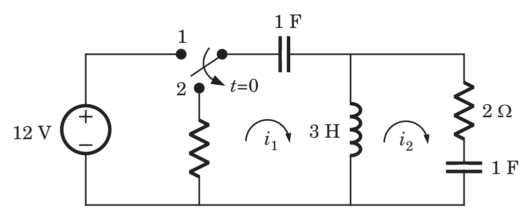


Fig. P1.8.11

(A) $\begin{bmatrix} 2 + 3s + \frac{1}{s} & -3s \\ -3s & 2 + \frac{1}{s} \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix} = \begin{bmatrix} \frac{12}{s} \\ 0 \end{bmatrix}$

(B) $\begin{bmatrix} 2+3s+\frac{1}{s} & -3s \\ -3s & 2+\frac{1}{s} \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix} = \begin{bmatrix} -\frac{12}{s} \\ 0 \end{bmatrix}$

(C) $\begin{bmatrix} 2+3s+\frac{1}{s} & -3s \\ -3s & 2+3s+\frac{1}{s} \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix} = \begin{bmatrix} -\frac{12}{s} \\ 0 \end{bmatrix}$

(D) $\begin{bmatrix} 2+3s+\frac{1}{s} & -3s \\ -3s & 2+3s+\frac{1}{s} \end{bmatrix} \begin{bmatrix} I_1(s) \\ I_2(s) \end{bmatrix} = \begin{bmatrix} \frac{12}{s} \\ 0 \end{bmatrix}$

12. In the circuit of fig. P1.8.12 at terminal ab Thevenin equivalent is

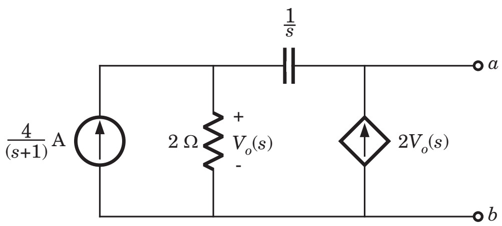


Fig. P1.8.12

(A) $V_{TH}(s) = \frac{-8(s+2)}{3s(s+1)}$, $Z_{TH}(s) = \frac{-(2s+1)}{3s}$

(B) $V_{TH}(s) = \frac{8(s+2)}{3s(s+1)}$, $Z_{TH}(s) = \frac{(2s+1)}{3s}$

(C) $V_{TH}(s) = \frac{4(s+3)}{3s(s+1)}$, $Z_{TH}(s) = \frac{(2s+1)}{6s}$

(D) $V_{TH}(s) = \frac{-4(s+3)}{3s(s+1)}$, $Z_{TH}(s) = \frac{-(2s+1)}{6s}$

13. In the circuit of fig. P1.8.13 just before the closing of switch at $t=0$, the initial conditions are known to be $v_{C1}(0^-) = 1$ V, $v_{C2}(0^-) = 0$. The voltage $v_{C1}(t)$ is

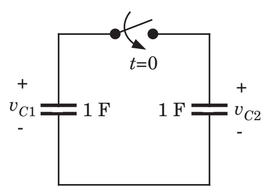


Fig. P1.8.13

(A) $u(t)$ V
(B) $0.5u(t)$ V
(C) $0.5e^{-t}$ V
(D) e^{-t} V

14. The initial condition at $t=0^-$ of a switched capacitor circuit are shown in Fig. P1.8.14. Switch S_1 and S_2 are closed at $t=0$. The voltage $v_a(t)$ for $t>0$ is

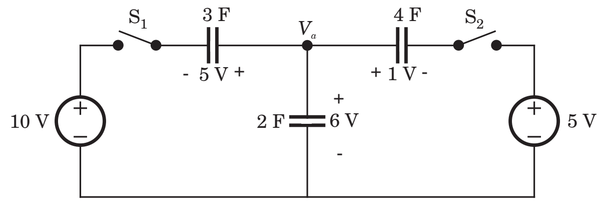


Fig. P1.8.14

(A) $\frac{9}{t}$ V
(B) $9e^{-t}$ V
(C) 9 V
(D) 0 V

15. A unit step current of 1 A is applied to a network whose driving point impedance is

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

The steady state and initial values of the voltage developed across the source would be respectively

(A) $\frac{3}{4}$ V, I V
(B) $\frac{1}{4}$ V, $\frac{3}{4}$ V
(C) $\frac{3}{4}$ V, 0 V
(D) 1 V, $\frac{3}{4}$ V

16. In the circuit of Fig. P1.8.16 $i(0) = 1$ A, $v_C(0) = 8$ V and $v_1 = 2e^{-2\times10^4 t}u(t)$. The $i(t)$ is

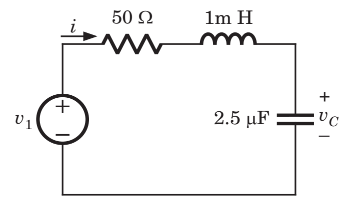


Fig. P1.8.16

(A) $\frac{1}{15}[10e^{-10^4 t} - 3e^{-2\times10^4 t} - 22e^{-4\times10^4 t}]u(t)$ A

(B) $\frac{1}{15}[-10e^{-10^4 t} + 3e^{-2\times10^4 t} + 22e^{-4\times10^4 t}]u(t)$ A

(C) $\frac{1}{3}[10e^{-10^4 t} + 3e^{-2\times10^4 t} + 22e^{-4\times10^4 t}]u(t)$ A

(D) $\frac{1}{3}[-10e^{-10^4 t} + 3e^{-2\times10^4 t} - 22e^{-4\times10^4 t}]u(t)$ A

17. In the circuit shown in Fig. P1.8.18 $v(0^-) = 8$ V and $i_{in}(t) = 4\delta(t)$. The $v_C(t)$ for $t \geq 0$ is

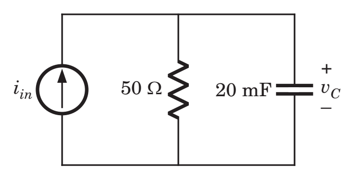


Fig. P1.8.17

(A) $164e^{-t}$ V
(B) $208e^{-t}$ V
(C) $208(1-e^{-3t})$ V
(D) $164e^{-3t}$ V

18. The driving point impedance $Z(s)$ of a network has the pole zero location as shown in Fig. P1.8.18. If $Z(0) = 3$, the $Z(s)$ is

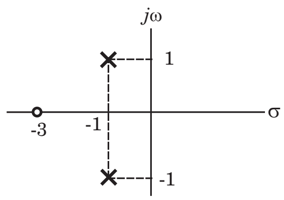


Fig. P1.8.18

(A) $\frac{4(s+3)}{s^2+s+1}$ (B) $\frac{2(s+3)}{s^2+2s+2}$

(C) $\frac{2(s+3)}{s^2+2s+2}$ (D) $\frac{4(s+3)}{s^2+s+2}$

Statement for Q.19-21:

The circuit is as shown in the fig. P1.8.19–21. All initial conditions are zero.

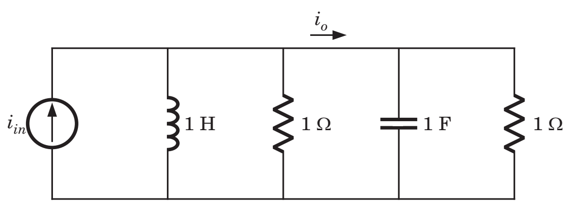


Fig. P1.8.19–21

19. $\frac{I_o(s)}{I_{in}(s)} = ?$

(A) $\frac{(s+1)}{2s}$ (B) $2s(s+1)^{-1}$

(C) $(s+1)s^{-1}$ (D) $s(s+1)^{-1}$

20. If $i_{in}(t) = 4\delta(t)$ then $i_o(t)$ will be

(A) $4\delta(t) - e^{-t}u(t)$ A

(B) $4\delta(t) - 4e^{-t}u(t)$ A

(C) $4e^{-t}u(t) - 4\delta(t)$ A

(D) $e^{-t}u(t) - \delta(t)$ A

21. If $i_{in}(t) = tu(t)$ then $i_o(t)$ will be

(A) $e^{-t}u(t)$ A (B) $(1 - e^{-t})u(t)$ A

(C) $u(t)$ A (D) $(2 - e^{-t})u(t)$ A

22. The voltage across 200 μF capacitor is given by

$$V_C(s) = \frac{2s+6}{s(s+3)}$$

The steady state voltage across capacitor is

(A) 6 V (B) 0 V

(C) ∞ (D) 2 V

23. The transformed voltage across the 60 μF capacitor is given by

$$V_C(s) = \frac{20s+6}{(10s+3)(s+4)}$$

The initial current through capacitor is

(A) 0.12 mA (B) −0.12 mA

(C) 0.48 mA (D) −0.48 mA

24. The current through an 4 H inductor is given by

$$I_L(s) = \frac{10}{s(s+2)}$$

The initial voltage across inductor is

(A) 40 V (B) 20 V

(C) 10 V (D) 5 V

25. The amplifier network shown in fig. P1.8.25 is stable if

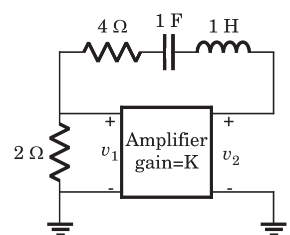


Fig.P1.8.25

(A) $K \le 3$ (B) $K \ge 3$

(C) $K \le \frac{1}{3}$ (D) $K \ge \frac{1}{3}$

26. The network shown in fig. P1.8.26 is stable if

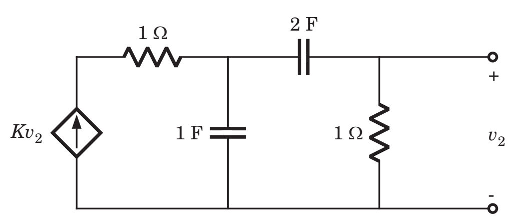


Fig.P1.8.26

(A) $K \ge \frac{5}{2}$ (B) $K \le \frac{5}{2}$

(C) $K \ge \frac{2}{5}$ (D) $K \le \frac{2}{5}$

27. A circuit has a transfer function with a pole $s = -4$ and a zero which may be adjusted in position as $s = -a$ The response of this system to a step input has a term of form Ke^{-4t}. The K will be (H= scale factor)

(A) $H\left(1-\frac{a}{4}\right)$ (B) $H\left(1+\frac{a}{4}\right)$

(C) $H\left(4-\frac{a}{4}\right)$ (D) $H\left(4+\frac{a}{4}\right)$

28. A circuit has input $v_{in}(t) = \cos 2t\, u(t)$ V and output $i_o(t) = 2\sin 2t\, u(t)$ A. The circuit had no internal stored energy at $t = 0$. The admittance transfer function is

(A) $\frac{2}{s}$ (B) $\frac{s}{2}$

(C) s (D) $\frac{1}{s}$

29. A two terminal network consists of a coil having an inductance L and resistance R shunted by a capacitor C. The poles of the driving point impedance function Z of this network are at $-\frac{1}{2} \pm j\frac{\sqrt{3}}{2}$ and zero at -1. If $Z(0) = 1$ the value of R, L, C are

(A) 3 Ω, 3 H, $\frac{1}{3}$ F (B) 2 Ω, 2 H, $\frac{1}{2}$ F

(C) 1 Ω, 2 H, $\frac{1}{2}$ F (D) 1 Ω, 1 H, 1 F

30. The current response of a network to a unit step input is

$$I_o = \frac{10(s+2)}{s^2(s+11s+30)}$$

The response is

(A) Under damped (B) Over damped

(C) Critically damped (D) None of the above

Statement for Q.31-33:

The circuit is shown in fig. P1.8.31-33.

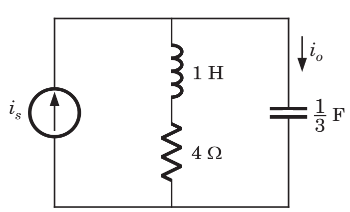


Fig. P1.8.31-33

31. The current ratio transfer function $\frac{I_o}{I_s}$ is

(A) $\frac{s(s+4)}{s^2+3s+4}$ (B) $\frac{s(s+4)}{(s+1)(s+3)}$

(C) $\frac{s^2+3s+4}{s(s+4)}$ (D) $\frac{(s+1)(s+3)}{s(s+4)}$

32. The response is

(A) Over damped (B) Under damped

(C) Critically damped (D) can't be determined

33. If input i_s is $2u(t)$ A, the output current i_o is

(A) $(2e^{-t} - 3te^{-3t})u(t)$ A (B) $(3te^{-t} - e^{-3t})u(t)$ A

(C) $(3e^{-t} - e^{-3t})u(t)$ A (D) $(e^{-3t} - 3e^{-t})u(t)$ A

34. In the network of Fig. P1.8.34, all initial condition are zero. The damping exhibited by the network is

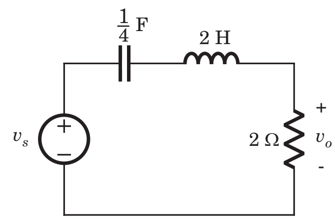


Fig. P1.8.34

(A) Over damped

(B) Under damped

(C) Critically damped

(D) value of voltage is requires

35. The voltage response of a network to a unit step input is

$$V_o(s) = \frac{10}{s(s^2+8s+16)}$$

The response is

(A) under damped (B) over damped

(C) critically damped (D) can't be determined

36. The response of an initially relaxed circuit to a signal v_s is $e^{-2t}u(t)$. If the signal is changed to $\left(v_s + \frac{2dv_s}{dt}\right)$, the response would be

(A) $5e^{-2t}u(t)$ (B) $-3e^{-2t}u(t)$

(C) $4e^{-2t}u(t)$ (D) $-4e^{-2t}u(t)$

37. Consider the following statements in the circuit shown in fig. P1.8.37

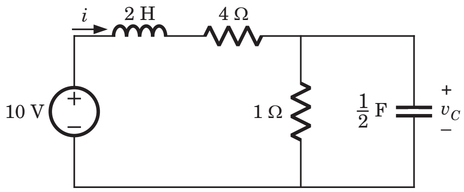


Fig. P1.8.37

1. It is a first order circuit with steady state value of $v_C = \frac{10}{3}$, $i = \frac{5}{3}$ A

2. It is a second order circuit with steady state of $v_C = 2$ V, $i = 2$ A

3. The network function $\frac{V(s)}{I(s)}$ has one pole.

4. The network function $\frac{V(s)}{I(s)}$ has two poles.

The true statements are

(A) 1 and 3 (B) 1 and 4

(C) 2 and 3 (D) 2 and 4

38. The network function $\frac{s^2 + 10s + 24}{s^2 + 8s + 15}$ represent a

(A) *RC* admittance (B) RL impedance

(C) LC impedance (D) None of the above

39. The network function $\frac{s(s+4)}{(s+1)(s+2)(s+3)}$ represents an

(A) *RC* impedance (B) *RL* impedance

(C) *LC* impedance (D) None of these

40. The network function $\frac{s(3s+8)}{(s+1)(s+3)}$ represents an

(A) *RL* admittance (B) *RC* impedance

(C) *RC* admittance (D) None of the above

41. The network function $\frac{(s+1)(s+4)}{s(s+2)(s+5)}$ is a

(A) *RL* impedance function

(B) *RC* impedance function

(C) *LC* impedance function

(D) Above all

42. The network function $\frac{s^2 + 7s + 6}{s + 2}$ is a

(A) *RL* impedance function (B) *RL* admittance

(C) *LC* impedance function (D) *LC* admittance

43. A valid immittance function is

(A) $\frac{(s+4)(s+8)}{(s+2)(s-5)}$ (B) $\frac{s(s+1)}{(s+2)(s+5)}$

(C) $\frac{s(s+2)(s+3)}{(s+1)(s+4)}$ (D) $\frac{s(s+2)(s+6)}{(s+1)(s+4)}$

44. The network function $\frac{s^2 + 8s + 15}{s^2 + 6s + 8}$ is a

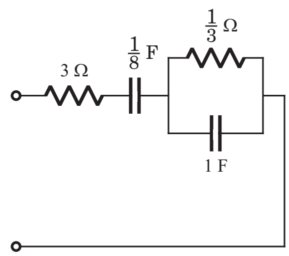
(A) *RL*admittance (B) *RC* admittance

(C) *LC* admittance (D) Above all

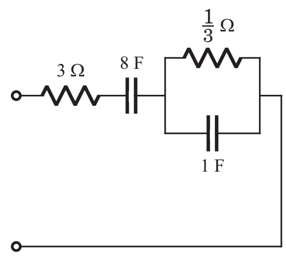
45. A impedance function is given as

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

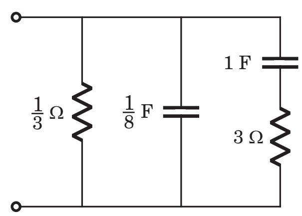
The network for this function is



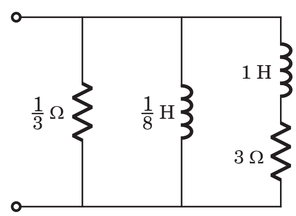
(A)



(B)



(C)



(D)

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18. (B) $Z(s) = \dfrac{K(s+3)}{(s-(-1+j))(s-(1-j))} = \dfrac{K(s+3)}{s^2+2s+2}$

$Z(0) = \dfrac{3K}{2} = 3 \quad \Rightarrow \quad K = 2$

19. (D) $\dfrac{I_o(s)}{I_{in}(s)} = \dfrac{\dfrac{s}{s+1}}{\dfrac{s}{s+1} + \dfrac{1}{s+1}} = \dfrac{s}{s+1}$

20. (B) $I_{in}(s) = 4$

$I_o(s) = \dfrac{4s}{s+1} = 4 - \dfrac{4}{s+1} \quad \Rightarrow \quad i_o(t) = 4\delta(t) - 4e^{-t}u(t)$

21. (B) $I_{in}(s) = \dfrac{1}{s^2}$,

$I_o(s) = \dfrac{1}{s(s+1)} = \dfrac{1}{s} - \dfrac{1}{s+1}$

$i_o(t) = u(t) - e^{-t}u(t) = (1-e^{-t})u(t)$

22. (D) $v_C(\infty) = \lim\limits_{s\to 0} sV_C(s) = \lim\limits_{s\to 0} \dfrac{2s+6}{s+3} = 2 \text{ V}$

23. (D) $v_C(0^+) = \lim\limits_{s\to\infty} sV_C(s) = \dfrac{s(20s+6)}{(10s+3)(s+4)} = 2 \text{ V}$

$i_C = \dfrac{Cdv_C}{dt} \quad \Rightarrow \quad I_C(s) = C[sV_C(s) - v_C(0^+)]$

$= 60 \times 10^{-6}\left(\dfrac{s(20\,s+6)}{(10s+3)(s+4)} - 2\right) = \dfrac{-480 \times 10^{-6}(10s+3)}{10s^2+43s+12}$

$i_C(0^+) = \lim\limits_{s\to\infty} sI_C(s) = -480 \times 10^{-6} = -0.48 \text{ mA}$

24. (A) $v_L = L\dfrac{d\,i_L}{dt} \Rightarrow V_L(s) = L[sI_L(s) - i_L(0^+)]$

$i_L(0^+) = \lim\limits_{s\to\infty} sI_L(s) = \dfrac{10}{s+2} = 0$

$V_L(s) = \dfrac{40s}{s(s+2)} = \dfrac{40}{s+2}$

$v_L(0^+) = \lim\limits_{s\to\infty} sV_L(s) = \dfrac{s40}{s+2} = 40$

25. (A) $V_2(s) = KV_1(s)$

$\Rightarrow \quad \dfrac{V_1(s)}{2} + \dfrac{V_1(s) - KV_1(s)}{4+s+\dfrac{1}{s}} = 0$

$4 + s + \dfrac{1}{s} + 2 - 2K = 0$

$\Rightarrow \quad s^2 + (6-2K)s + 1 = 0$

$(6-2K) > 0 \quad \Rightarrow \quad K < 3$

26. (B) Let v_1 be the node voltage of middle node

$V_1(s) = \dfrac{KV_2(s) + 2sV_2(s)}{1+2s+s}$

$\Rightarrow \; (3s+1)V_1(s) = (2s+K)V_2(s)$

$\Rightarrow \quad V_2(s) = \dfrac{2sV_1(s)}{2s+1}$

$\Rightarrow \; (2s+1)V_2(s) = 2sV_1(s)$

$\Rightarrow \; (3s+1)(2s+1) = 2s(2s+K)$

$2s^2 + (5-2K)s + 1 = 0,$

$5 - 2K > 0, \; K < \dfrac{5}{2}$

27. (A) $H(s) = \dfrac{H(s+a)}{s+4}$

$R(s) = \dfrac{H(s+a)}{s(s+4)} = \dfrac{Ha}{4s} + \dfrac{H\left(1-\dfrac{a}{4}\right)}{s+4}$

$r(t) = \dfrac{Ha}{4}u(t) + H\left(1 - \dfrac{a}{4}\right)e^{-4t}$

28. (A) $V_{in}(s) = \dfrac{s}{s^2+1}$, $I_o(s) = \dfrac{2}{s^2+1}$, $\dfrac{I_o(s)}{V_{in}(s)} = \dfrac{2}{s}$

29. (D) $Z(s) = \dfrac{(sL+R)\dfrac{1}{sC}}{sL+R+\dfrac{1}{sC}} = \dfrac{\dfrac{1}{C}\left(s+\dfrac{R}{L}\right)}{s^2+\dfrac{R}{L}+\dfrac{1}{LC}}$

$Z(s) = \dfrac{K(s+1)}{\left(s+\dfrac{1}{2}+j\dfrac{\sqrt{3}}{2}\right)\left(s+\dfrac{1}{2}-j\dfrac{\sqrt{3}}{2}\right)} = \dfrac{K\,(s+1)}{(s^2+s+1)}$

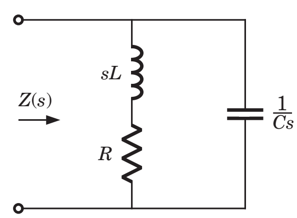

Fig. S1.8.29

Since $Z(0) = 1$, thus $K = 1$

$\dfrac{1}{C} = 1, \; \dfrac{R}{L} = 1, \; \dfrac{1}{LC} = 1$

$\Rightarrow \quad C = 1, \; L = 1, \; R = 1$

30. (B) The characteristic equation is

$s^2(s^2+11s+30) = 0 \quad \Rightarrow \quad s^2(s+6)(s+5) = 0$

$s = -6, \; -5$, Being real and unequal, it is overdamped.

31. (B) $\dfrac{I_o}{I_s} = \dfrac{s+4}{s+4+\dfrac{3}{s}} = \dfrac{s(s+4)}{(s+1)(s+3)}$

32. (A) The characteristic equation is $(s+1)(s+3)=0$.

Being real and unequal root, it is overdamped response.

33. (C) $i_s = 2u(t) \quad \Rightarrow \quad I_s(s) = \dfrac{2}{s}$

$$I_o(s) = \frac{2(s+4)}{(s+1)(s+3)} = \frac{3}{s+1} - \frac{1}{s+3}$$

$i_o = (3e^{-t} - e^{-3t})u(t)$ A

34. (B) $\dfrac{V_o(s)}{V_s(s)} = \dfrac{2}{\dfrac{4}{s}+2s+2} = \dfrac{1}{s^2+s+2}$

The roots are imaginary so network is underdamped.

35. (C) The characteristic equation is

$s(s^2+8s+16)=0,\ (s+4)^2=0,\ s=-4,-4$

Being real and repeated root, it is critically damped.

36. (B) $v_o = e^{-2t}u(t) \quad \Rightarrow \quad V_o(s) = H(s)V_s(s) = \dfrac{1}{s+2}$

$v_s' = v_s + \dfrac{2dv_s}{dt} \quad \Rightarrow \quad V_s'(s) = (1+2s)V_s(s)$

$V_o'(s) = H(s)V_s'(s) = (1+2s)V_s(s)H(s)$

$V_o'(s) = \dfrac{1+2s}{s+2} = 2 - \dfrac{3}{s+2} \quad \Rightarrow \quad v_o' = 2\delta(s) - 3e^{-2t}u(t)$

37. (C) It is a second order circuit. In steady state

$i = \dfrac{10}{4+1} = 2$ A , $v = 2\times 1 = 2$ V

$$I(s) = \frac{10}{2s+4+\dfrac{1}{1+\dfrac{1}{2}s}} = \frac{5(s+2)}{(s+2)^2+1}$$

$$V(s) = \frac{\dfrac{10}{1+\dfrac{1}{2}s}}{(2s+4)+\dfrac{1}{1+\dfrac{1}{2}s}} = \frac{10}{(s+2)^2+1}$$

$\dfrac{V(s)}{I(s)} = \dfrac{2}{s+2}$, It has one pole at $s=-2$

38. (D) $\dfrac{s^2+10s+24}{s^2+8s+15} = \dfrac{(s+4)(s+6)}{(s+3)(s+5)}$

The singularity near to origin is pole. So it may be *RC* impedance or *RL* admittance function.

39. (D) Poles and zero does not interlace on negative real axis so it is not a immittance function.

40. (C) The singularity nearest to origin is a zero. So it may be *RL* impedance or *RC* admittance function. Because of (D) option it is required to check that it is a valid *RC* admittance function. The poles and zeros interlace along the negative real axis. The residues of $\dfrac{Y_{RC}(s)}{s}$ are real and positive.

41. (B) The singularity nearest to origin is a pole. So it may be *RC* impedance or *RL* admittance function.

42. (A) $\dfrac{s^2+7s+6}{s+2} = \dfrac{(s+1)(s+6)}{(s+2)}$

The singularity nearest to origin is at zero. So it may be *RC* admittance or *RL* impedance function.

43. (D)

(A) pole lie on positive real axis

(B) poles and zero does not interlace on axis.

(C) poles and zero does not interlace on axis.

(D) is a valid immittance function.

44. (A) $\dfrac{s^2+8s+15}{s^2+6s+8} = \dfrac{(s+3)(s+5)}{(s+2)(s+4)}$

The singularity nearest to origin is a pole. So it may be a *RL* admittance or *RC* impedance function.

45. (A) The singularity nearest to origin is a pole. So this is *RC* impedance function.

$$Z(s) = 3 + \frac{8}{s} + \frac{1}{s+3} = 3 + \frac{8}{s} + \frac{1/3}{1+\dfrac{s}{3}}$$

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