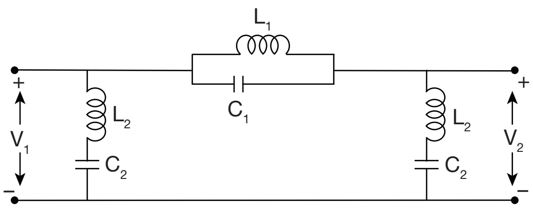
ELECTRIC CIRCUITS AND FIELDS TEST I

Number of Questions: 35 **Section Marks: 90**

Directions for questions 1 to 35: Select the correct alternative from the given choices.

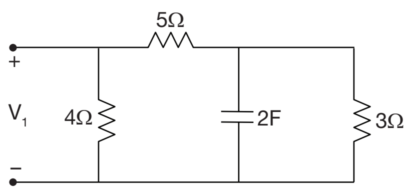
1.



Given filter is

(A) Band pass filter
(B) Band stop filter
(C) Low pass filter
(D) High pass filter

2. The driving point impedance of the circuit shown in below figure is



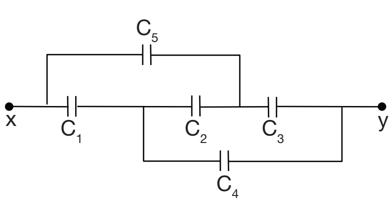
(A) $\dfrac{60s+16}{27s+6}$ (B) $\dfrac{27s+6}{60s+16}$

(C) $\dfrac{64s+60}{24s+27}$ (D) $\dfrac{24s+27}{64s+60}$

3. A parallel RLC circuit has R = 1kΩ, L = 4mH and C = 10μF then Q is

(A) 2×10^{-2} (B) 200
(C) 100 (D) 50

4.

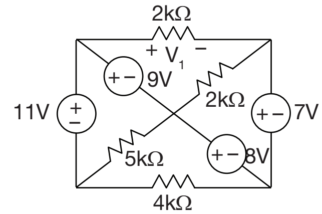


In given figure the capacitors – C_1, C_2, C_3, C_4, C_5 have capacitance of 4F, 10F 4F, 8F, 2F respectively. Then the effective capacitance between the points x & y will be

(A) 4F (B) $\dfrac{4}{3}$F

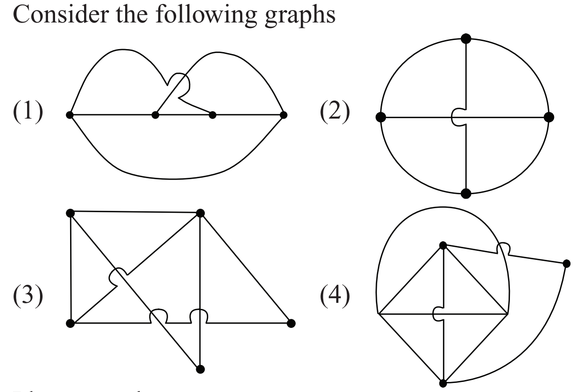
(C) $\dfrac{8}{3}$F (D) $\dfrac{1}{4}$F

5. In given below circuit the voltage V_1 is



(A) 2V (B) 6V
(C) 1V (D) 10V

6. Consider the following graphs



Planar graphs are

(A) All (B) 1,3
(C) 1, 2 (D) 1, 2, 3

7. Function $s + 4 + \dfrac{5}{s}$ can be realized

(A) as an admittance but not as an impedance.
(B) as an impudance but not as an admittance
(C) both as driving point impedance and as a driving point admittance
(D) neither as an impedance nor as an admittance

8. Width of resonance curve in a $R – L – C$ network is determined by

(A) R alone (B) L alone
(C) C alone (D) All R, L, and C

9. If two, two – port networks, are connected such that, the short circuit admittance matrix of the overall network is sum of the short circuit admittance matrices of individual networks, find type of connection?

(A) series connection (B) parallel connection
(C) cascade connection (D) None of these

10. With respect to Hybrid parameters, which one of the following statement is correct ?

(A) h_{11} and h_{22} are dimension less
(B) h_{12} and h_{22} are dimension less
(C) h_{21} and h_{12} are dimension less
(D) h_{11} and h_{21} are dimension less

11. It is required to find the current through a particular branch of a linear bilateral network without mutual coupling when the branch impedance takes five different values which one of the following method is preferred?

(A) Mesh analysis
(B) super position theorem
(C) The venin's equivalent circuit
(D) Nodal analysis

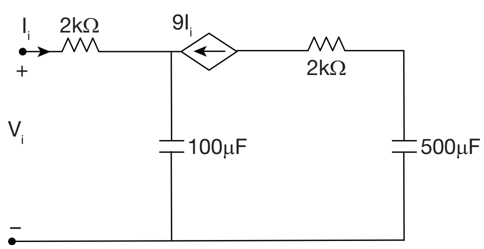
12. The Number of fundamental cut – sets of any graph will be equal to

(A) Number of tree branches
(B) Number of twigs
(C) Number of nodes
(D) Number of loops

13. Consider a 48V battery of internal resistance is 6 Ω connected to a load resistance. The rate of heat dissipated in the resistor is maximum when the current drawn from the battery is *i*. the current drawn from the battery will be $\frac{i}{3}$ when R_L is equal to

(A) 30Ω (B) 24Ω
(C) 6Ω (D) 12Ω

14.



The input capacitance is

(A) 600 mF (B) 50 mF
(C) 10 mF (D) 200 mF

15. Reactive power is given as 500 VAR and leading power factor is 0.6, then Apparent power is

(A) 833.33VA (B) 625VA
(C) 666.67VA (D) 500VA

16. For given Two port network. The Transmission matrix is

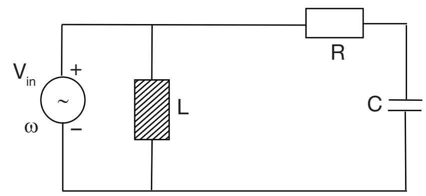
(A) $\begin{bmatrix} 2 & 5 \\ 5 & 3 \end{bmatrix}$ (B) $\begin{bmatrix} 7 & -5 \\ -5 & 8 \end{bmatrix}$

(C) $\begin{bmatrix} 1.6 & 0.2 \\ 6.2 & 1.4 \end{bmatrix}$ (D) $\begin{bmatrix} 2.67 & 0.67 \\ 10.67 & 1.67 \end{bmatrix}$

17. For a series $R-L-C$ circuit, the characteristic equation is given by $S^2+\frac{R}{L}S+\frac{1}{LC}=0$. If $\frac{R}{2L}$ is denoted by α and $\frac{1}{\sqrt{LC}}$ by β, then under the condition $\beta^2 < \alpha^2$, the system will be

(A) critically damped (B) under damped
(C) undamped (D) over damped

18.

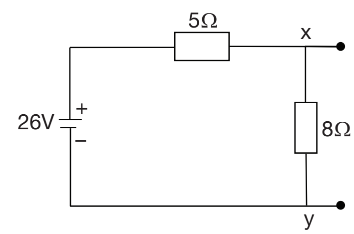


Consider given circuit and find the value of ω where circuit exhibits unity power factor?

(A) $\frac{1}{\sqrt{LC}}$ (B) $\frac{1}{RC}$

(C) $\frac{1}{\sqrt{LC+R^2C^2}}$ (D) $\frac{1}{\sqrt{LC-R^2C^2}}$

19. If two circuits shown below are equivalent then which one of the following is correct

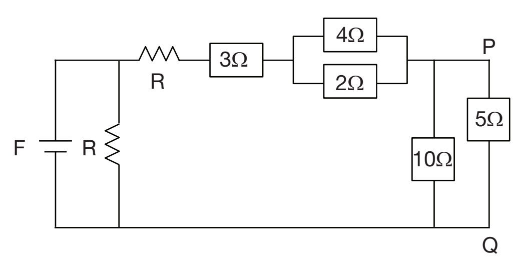


1 $E = -2$V and $R = 9Ω$
2 $E = -4$V and $R = 6Ω$
3 $E = -$V and $R = 4Ω$
4 without knowing R_o value we cannot find R and E values

Select the correct option

(A) 1 and 2 only (B) 4 only
(C) 2 and 3 only (D) 1, 2 and 3 only.

20. In given circuit, the voltage across 3Ω resistor is 30V. The 5Ω resistor is connected between the terminal *P* and *Q* can be replaced by an ideal



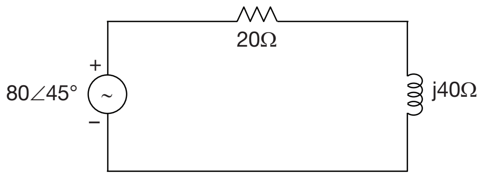
(A) voltage source of $\frac{100}{3}$V with '+*ve*' terminal in upward direction

(B) voltage source of $\frac{100}{3}$V with '+*ve*' terminal in downward direction

(C) current source of $\frac{10}{3}$A in up ward direction

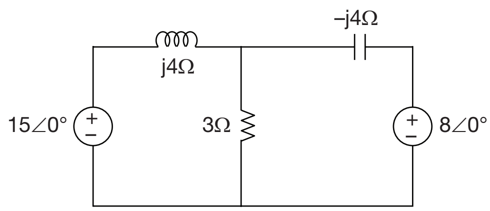
(D) current source $\frac{10}{3}$A in down ward direction

21. Find the change in current in below given circuit by compensation theorem, when the reactance has changed to $j20\Omega$



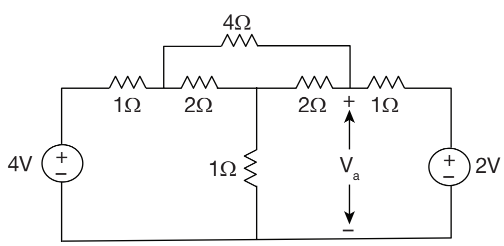
(A) 1.79 ∠–18.438 (B) 0.56 ∠–18.438
(C) 28.28∠45° (D) 1.26 ∠26.57°

22. The average power absorbed by the, resistor and Would be.



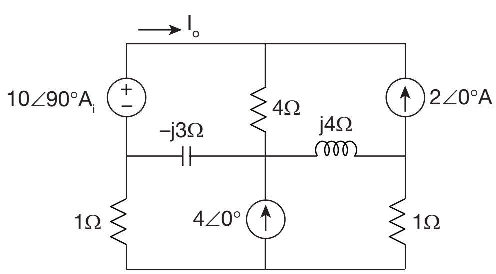
(A) 0 W (B) 4.6 W
(C) 2.3 W (D) 9.2 W

23.



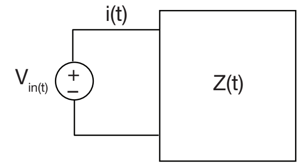
The value of V_a in the given network is?
(A) 2.9 V (B) 1.2 V
(C) 1.9 V (D) 2.5 V

24. In the given circuit the current I_o is



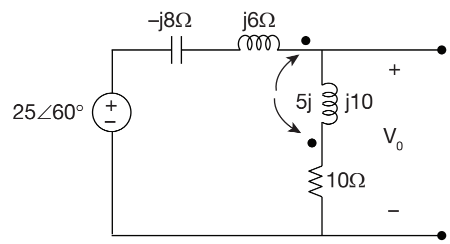
(A) 6∠0° (B) 2∠0°
(C) 5 ∠107.4 (D) 4∠57°

25. The circuit given below has input impedance $z(t)$ Assume zero initial conditions for an input $V_{in}(t) = 10t\, e^{-10t}u(t)$. Current in the circuit at t = 50ms will be



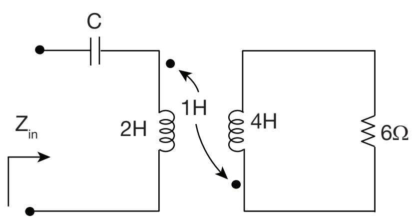
Where $Z(t) = e^{-10t}(1 + 10t)\, u(t)$
(A) 10A (B) 6.7mA
(C) 6mA (D) 3.6A

26.



The output voltage V_o is
(A) 21.88 ∠55.36° V (B) 30.35∠89.06° V
(C) 28.4∠80° V (D) 35.13∠77.65° V

27. In the following circuit if w = 3rad/s, the resonance occurs when C is



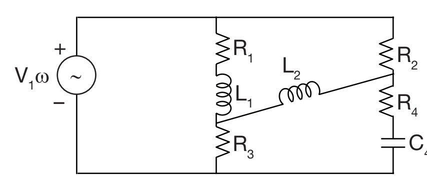
(A) $\frac{5}{81}$F

(B) 4F

(C) $\frac{1}{324}$F

(D) Not possible to get resonance

28. The circuit shown in below figure, if the current through inductor 'L_2' is Zero Then Which one of the following relation is correct



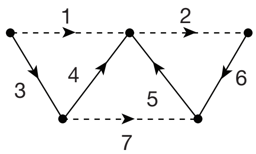
(A) $\frac{\omega L_1}{R_1} = \frac{1}{\omega C_4 R_4}$

(B) $\tan^{-1}\frac{\omega L_1}{R} + \tan^{-1}\omega C_4 R_3 = 0$

(C) $\tan^{-1}\dfrac{\omega L_1}{R_1} + \tan^{-1}\dfrac{1}{\omega C_4 R_3} = 0$

(D) $\dfrac{\omega L_1}{R} = R_4 C_4 \omega$

29. Which one of the following Matrix is cutset matrix for a given graph.



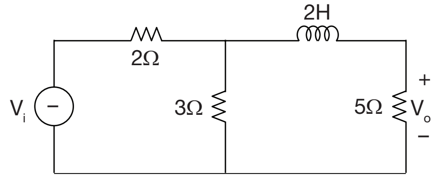
(A) $\begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & -1 & 0 & 0 & 1 & 0 & -1 \\ 0 & -1 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & -1 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} -1 & -1 & 0 & 0 \\ 0 & 0 & 1 & -1 \\ +1 & 0 & 0 & 0 \\ 0 & +1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & +1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

(D) $\begin{bmatrix} -1 & 0 & -1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & -1 & 0 & 0 & 1 \\ 0 & -1 & 0 & 0 & -1 & 0 & 1 \\ 0 & +1 & 0 & 0 & 0 & +1 & 0 \end{bmatrix}$

30. Find the response of given network when V_i = 6cos3t volts.



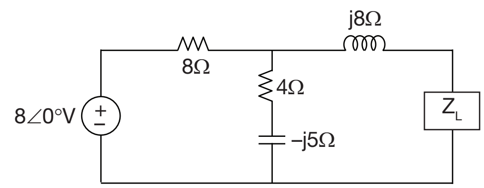
(A) 0.29cos3t +0.36sin 3t V

(B) $e^{-2.4t}$ + 0.29cos3t V

(C) $\dfrac{12}{41}e^{-2.4t} - 0.36\cos 3t$ V

(D) 2cos (3t – 44)$^{-V}$

31. Maximum average power can be transferred by given network is

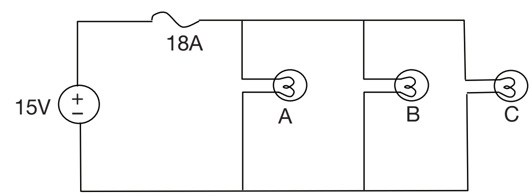


(A) zero Watts (B) 0.283 Watts

(C) 0.56 Watts (D) 0.637 Watts

Common data for questions 32 and 33:

In given circuit bulb A uses 30W when it is ON, Bulb B, uses 20W when it is ON, bulb C uses 15W when light is ON,



32. The additional A bulbs in parallel to this circuit, that would be required to blow the fuse is

(A) 5 (B) 7

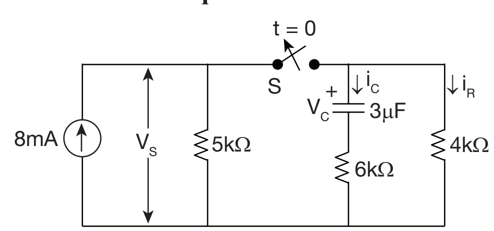
(C) 4 (D) 8

33. How many additional parallel A, B, C bulbs in parallel are required to blow the fuse is

(A) 5 (B) 4

(C) 3 (D) 6

Data for Linked Answer questions 34 and 35:



34. The value of V_s is

(A) 17.8 V (B) 40 V

(C) 22.2 V (D) zero V

35. Find the voltage across capacitor for $t \geq 0$.

(A) $\dfrac{160}{9}\left(e^{\frac{-100t}{3}} - 1\right)$V (B) $\dfrac{160}{9}e^{\frac{-100t}{3}}$V

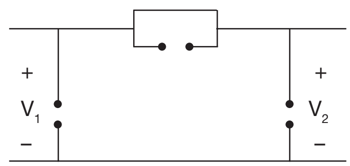
(C) $\dfrac{-16}{9}\times\left(e^{\frac{-100t}{3}} - 1\right)$mV (D) None of the above

Answer Keys

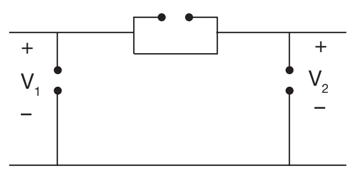
1. B	**2.** A	**3.** D	**4.** A	**5.** D	**6.** D	**7.** C	**8.** D	**9.** B	**10.** C
11. D	**12.** B	**13.** A	**14.** C	**15.** B	**16.** C	**17.** D	**18.** D	**19.** D	**20.** A
21. D	**22.** B	**23.** C	**24.** C	**25.** D	**26.** A	**27.** A	**28.** A	**29.** A	**30.** D
31. C	**32.** B	**33.** B	**34.** A	**35.** B					

Hints and Explanations

1. If $\omega = 0$ then $L \to S.C$
$C \to O.C$ then output is across capacitor.

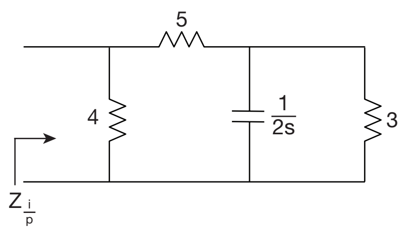


If $\omega = \to$ then $L \to O.C$
$C \to S.C$ then outputs is across inductor



So it is Band stop filter Choice (B)

2.



$$Z_{\frac{i}{p}} = 4\left[5 + \left(3 \,||\, \frac{1}{2s}\right)\right]$$

$$\frac{60s+16}{27s+6}$$ Choice (A)

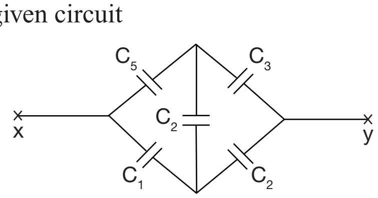
3. $Q = \omega CR$

$$= RC\frac{1}{\sqrt{LC}} = R\sqrt{\frac{C}{L}}$$

$$= 10^3\sqrt{\frac{10\times10^{-6}}{4\times10^{-3}}}$$

$$= 10^3\sqrt{\frac{10^{-2}}{4}} = \frac{100}{2} = 50$$ Choice (D)

4. Redraw given circuit



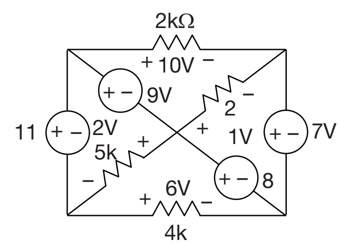
$C_1\, C_3 = C_4\, C_5$
Given Network is balanced bridge

$$C_{eq} = \frac{C_5 \times C_3}{C_5 + C_3} + \frac{C_4 C_1}{C_4 + C_1}$$

$$= \frac{4\times8}{12} + \frac{4\times2}{6}$$

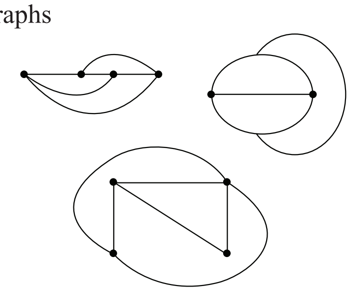
$C_{eq} = 4\text{F}$ Choice (A)

5.



Choice (D)

6. Redraw graphs



But we can't draw diagram (4) Choice (D)

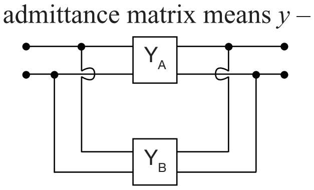
7. $F(S) = s + 4 + \frac{5}{3}$

If $F(S)$ is a driving point admittance then capacitor of 1F, resistor of $\frac{1}{5}\Omega$, inductor of $\frac{1}{5}$H

If $F(S)$ is a driving point impedance then capacitor of $0.2F$, Resistor of 4Ω, inductor of 1H. Choice (C)

8. Bandwidth of resonance curve is determined by all R, L, C Choice (D)

9. Short circuit admittance matrix means y – matrix.



$Y_{eq} = Y_A + Y_B$. For parallel connection Choice (B)

10. $h_{11} = \frac{V_1}{I_1}$ ohms $h_{22} = \frac{I_2}{V_2}$ **mho**

$h_{12} = \frac{V_1}{V_2}$ No dimensions

$h_{21} = \frac{I_2}{I_1}$ No dimensions Choice (C)

11. In order to find current through a particular branch in a linear Network, Nodal Analysis is preffered

Choice (D)

12. Choice (B)

13. Maximum heat dissipation will occur when $r\ R_L = 6\ \Omega$

$i = \frac{48}{12} = 4\text{A}$

$\frac{i}{3} = \frac{48}{6 + R_L^1} = \frac{4}{3}$

$R_L^1 = 30$ Choice (A)

14. $V_i(S) = 2 \times 10^3{}_i(s) + \frac{1}{s \times 10^{-4}} \times 10 I_i(s)$

$\Rightarrow \frac{V_i(s)}{I_i(s)} = 2\times 10^3 + \frac{10^5}{s}$

$C_{\frac{i}{p}} = \frac{1}{10^5} = 10\mu\text{F}$ Choice (C)

15. $Q = 500$ VAR

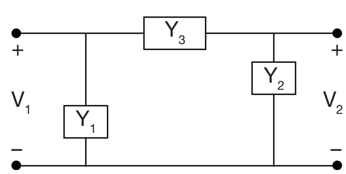
$P.F = 0.6 = \cos\theta$

$\sin\theta = 0.8$

$s = \frac{Q}{\sin\theta} = \frac{500}{0.8} = 625$ VA Choice (B)

16. $\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 1 + \frac{Y_2}{Y_3} & \frac{1}{Y_3} \\ Y_1 + Y_2 + \frac{Y_1 Y_2}{Y_3} & 1 + \frac{Y_1}{Y_3} \end{bmatrix}$

Where



$\begin{bmatrix} 1 + \frac{3}{5} & \frac{1}{5} \\ 2 + 3 + \frac{6}{5} & 1 + \frac{2}{5} \end{bmatrix} = \begin{bmatrix} 1.6 & 0.2 \\ 6.2 & 1.4 \end{bmatrix}$ Choice (C)

17. From given equation $2\xi\omega_n = \frac{R}{L}$

$\xi = \frac{R}{2L \times \frac{1}{LC}} = \frac{R}{2}.\sqrt{\frac{C}{L}}$

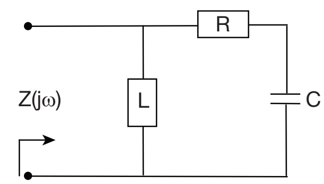
$\beta^2 < \alpha^2 \Rightarrow \frac{1}{LC} < \left(\frac{R}{2L}\right)^2$

$\Rightarrow \frac{R}{2}.\sqrt{\frac{C}{L}} > 1$

$\xi > 1$

So it is over damped Choice (D)

18.



$$z(j\omega) = \frac{j\omega L\left(R - \frac{j}{\omega c}\right)}{R + j\omega L - \frac{j}{\omega c}}$$

$$= \frac{j\omega L\left(R - \frac{j}{\omega c}\right)\left(R - j\omega L + \frac{j}{\omega c}\right)}{\left(R + j\omega L - \frac{j}{\omega c}\right)\left(R - j\omega L + \frac{j}{\omega c}\right)}$$

Equating imaginary part to zero $R^2 - \frac{L}{C} + \frac{1}{\omega^2\ C^2}$

$\Rightarrow \omega = \frac{1}{\sqrt{LC - R^2 C^2}}$ Choice (D)

19. Voltage across $xy = \frac{8 \times 26}{13} = 16\text{V}$

Current through 8Ω is $\frac{16}{8} = 2\text{A}$

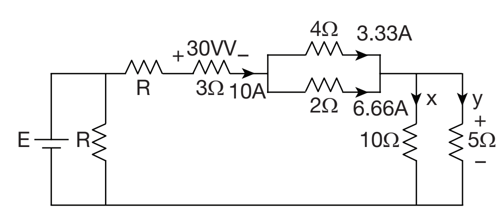
In second circuit $IR + E = 16\text{V} \Rightarrow 2\ R + E = 16$

$R = 4$ and $E = 8$

$R = 6$ and $E = 4$

$R = 9$ and $E = -2$ Choice (D)

20.



$x + y = 10$

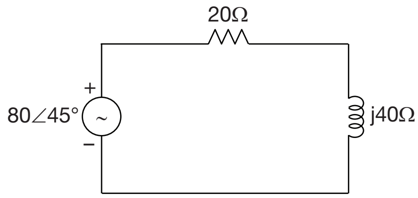
$10x = 5y \Rightarrow 2 = y$

$x = \frac{10}{3}$; $y = \frac{20}{3}$

$\Rightarrow$ voltage across of 5Ω resistor is $\frac{100}{3}$V

Choice (A)

21.



From compensation theorem, change in current

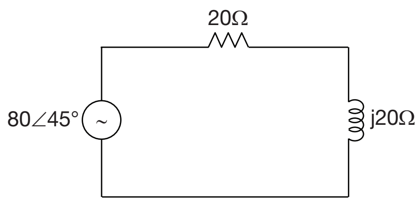
$$\Delta I = \frac{I\Delta Z}{Z_{total}}$$

$$I = \frac{V}{Z} = \frac{80\angle 45°}{20+j40} = \frac{80\angle 45°}{44.7\angle 63.43} = 1.79\ \angle -18.434$$

$\Delta Z = j40 - j20 = j20\Omega$

$Z_{total} + = 20 + j20 = 28.28$

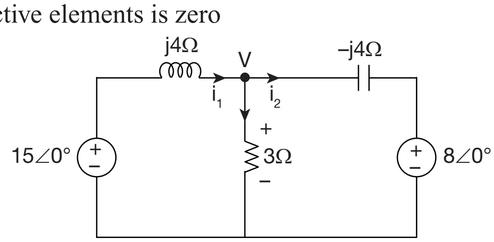
$$\Delta I = \frac{1.79\angle -18.434 \times j20}{28.28\angle 45°}$$



$$= \frac{1.79\times 20}{28.28}\angle 90 - 45° - 18.434$$

$=1.26\ \angle\ 26.566°$ Choice (D)

22. We know that the average power observed by the two reactive elements is zero



$$\frac{V-15}{j4} + \frac{V}{3} + \frac{V-8}{-j4} = 0$$

$$\Rightarrow \quad V\left[\frac{j}{4} + \frac{1}{3} + \frac{1}{j4}\right] = \frac{15}{j4} - \frac{8}{j4}$$

$$\frac{V}{3} = \frac{7}{j4} \Rightarrow V = \frac{-j21}{4}$$

Current flowing through R is $\frac{V}{R} = \frac{-j21}{4\times 3}$

$$\frac{-7}{4}\angle 90° = \frac{7}{4}\angle -90°$$

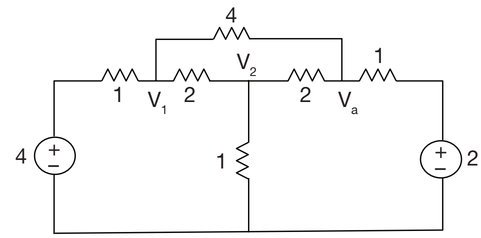
So $I_{max} = \frac{7}{4}$

The average power absorbed by resistor is

$$P_R = \frac{1}{2} I_m^2 R$$

$$P_R = \frac{1}{2} \times \frac{49}{16} \times 3 = 4.6\text{W}$$ Choice (B)

23.



Nodal Analysis at V_1 $\frac{V_1 - 4}{1} + \frac{V_1 - V_2}{2} + \frac{V_1 - V_a}{4} = 0$

$7V_1 - 2V_2 - V_a = 16$ $\rightarrow (1)$

Nodal Analysis a V_2

$$\frac{V_2}{1} + \frac{V_2 - V_1}{2} + \frac{V_2 - V_a}{2} = 0$$

$4V_2 - 2V_1 = V_a$ $\rightarrow (2)$

At V_a

$$\frac{V_a - 2}{1} + \frac{V_a - V_2}{2} + \frac{V_a - V_1}{4} = 0$$

$-4V_1 - 13V_2 = 4$ $\rightarrow (3)$

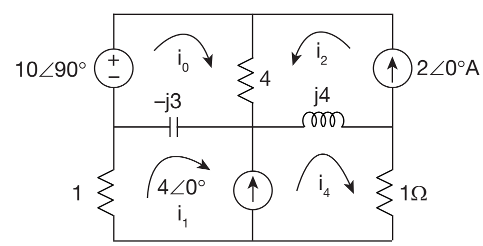
After solving three equations we will get

$V_1 = 2.9$

$V_2 = 1.2$

$V_a = 1.9$ V Choice (C)

24. Given circuit is



$i_2 = 2\angle 0°$

$i_o - i_1 + i_4 = 4\angle o°\angle @$

$I_1 - j3\ (I_1 - I_o) + j4\ (I_2 + I_4) + i_4 = 0$

$I_1[1 - 3j] + 3jI_o + j4\, i_2 + I_4\,(1 + j4) = 0$

$I_1[1 - j3] + j3I_o + j8\angle 0° + I_4\,(1 + j4) = 0$

$I_1[1 - j3] + j3I_o + j8 + I_4\,(1 + j4) = 0$ --- (b)

$10\angle 90° = 4\,(2\angle 0° + I_o) + (I_o - I_1)\,(-j3)$

$10\angle 90° - 8 = I_o\,(4 - j3) + j3I_1$

$-8 + 10j = I_o[4 - j3] + j3I\ \angle\ (C)$

Solving above equation we will get

$I_o = 5.01\ \angle\ 107.4$ Choice (C)

25. Given that $Z(t) = e^{-10t}\,[1 + 10t]\,u(t)$

$$Z(s) = \frac{1}{s+10} + \frac{10}{(s+10)^2} = \frac{s+20}{(s+10)^2}$$

$V(s) = I(s) . Z(s)$

$$I(S) = \frac{V(s)}{Z(s)} = \frac{10}{(s+10)^2}\frac{(s+10)^2}{(s+20)} = 10e^{-20t}$$

At t = 50ms

$$= 10\ e^{-20\times 50\times 10^{-3}}$$

$$= 10\ e^{-1} = 3.6\text{A}$$

Choice (D)

26. $$V_o = \frac{25\angle 60^\circ \times [j10+j5+10]}{-j8+j6+j10+(2\times j5)+10}$$

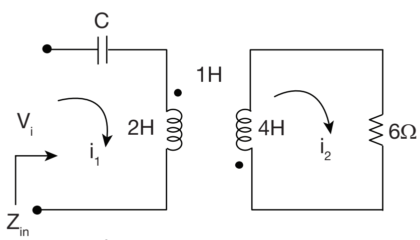
$$= \frac{25\angle 60^\circ(10+j15)}{10+j18}$$

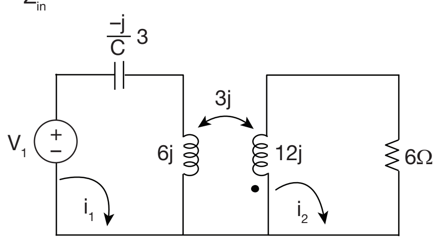
$$= \frac{25\times 18\angle 116.3}{20.59\angle 60.94}$$

$= 21.88 \angle 55.36$ volts

Choice (A)

27. Given circuit is





$$V_1 = \frac{-jI_1}{3C} + j6I_1 - j3I_2$$

$12jI_2 + 6I_2 - 3jI_1 = 0$

$I_2\,[_2 + j4] = jI_1$

$$I_2 = \frac{j}{(2+j4)}I_1$$

$$V_1 = \frac{-jI_1}{3C} + j6I_1 + \frac{3I_1}{(2+j4)}$$

$$V_1 = I_1\left[\frac{-j}{3c} + j6 + \frac{3(2-j4)}{20}\right]$$

At resonance imaginary part equal to zero

$$\frac{-j}{3C} + j6 - \frac{12j}{20} = 0$$

$$6 - \frac{12}{20} = \frac{1}{3C}$$

$$C = \frac{5}{81}$$

Choice (A)

28. The condition to balance given circuit is

$$\frac{R_2}{R_1 + j\omega L_1} = \frac{R_4 - \dfrac{j}{\omega C_4}}{R_3}$$

$$R_2\ R_{3=}\left(R_4 - \frac{j}{\omega c_4}\right)(R_1 + j\omega L_1)$$

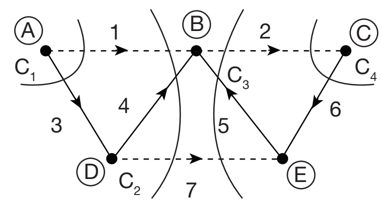
Imaginary part is equal to zero

$$\omega L_1 R_4 - \frac{R_1}{\omega c_4} = 0$$

$$\frac{\omega L_1}{R_1} = \frac{1}{\omega c_4 R_4}$$

Choice (A)

29.

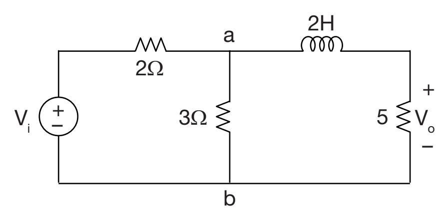


No. of cut sets = Number of twigs = 4

Cut sets	1	2	3	4	5	6	7
C_1	1	0	1	0	0	0	0
C_2	1	0	0	1	0	0	1
C_3	0	–1	0	0	1	0	–1
C_4	0	–1	0	0	0	1	0

Choice (A)

30. Given circuit is



$$V = \frac{5}{5+2s}V_{ab}$$

$$V_{ab} = \frac{3//(5+2s)}{2+[3//(5+2s)]}V_i$$

$$= \frac{15+6s}{31+10s}V_i$$

$$V_{o(s)} = \frac{5(15+6s)}{(5+2s)(31+10s)}V_i = \frac{15}{31+10s}V_{i(s)}$$

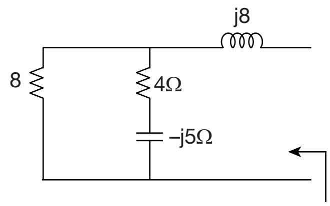
$$V_o = \frac{15}{31+105}V_i(s)$$

$= 2.08 \cos(3t - 4)$

$= 1.49 \cos 3t + 1.44 \sin 3t$

Choice (D)

31.



$[8//4 - j5] + j8 = z_{th}$

$Z_{th} = 60.88 \angle 83.53°$
$= 6.38 + j60.497$

$$P_{\text{max avg}} = \frac{(V_{th})^2}{4R_{th}}$$

$$V_{th} = \frac{8\times(4-j5)}{8+4-j5}$$

$$= \frac{8(4-j5)}{12-j5} = \frac{51.22}{13}\angle -51.34 + 22.61$$

$= 3.94 \angle -28.73$

$$P_{\text{max avg}} = \frac{(3.92)^2}{4\times 6.86} = 0.56\text{W}$$ Choice (C)

32. $i_A = \frac{30}{15} = 2\text{A}$

$$i_B = \frac{20}{15} = \frac{4}{3}\text{A}$$

$$i_C = \frac{15}{15} = 2\text{A}$$

Current required to blow the fuse is = 18_A

So additional bulbs must draw = 18 – $\left(2 + \frac{4}{3} + 1\right)$

=13.66

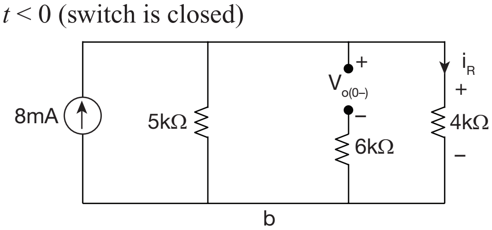
No. of additional bulbs = 13.66/2 = 6.833
= 7 Choice (B)

33. Each set of parallel A, B, C bulbs is drawing 4.33 Amperes of current
Current required to blow the fuse is 18A

No. of bulbs required = $\frac{18\times 3}{13} = 4.15 \approx 5$

Additional No. of sets are 4 Choice (B)

34. For $t < 0$ (switch is closed)



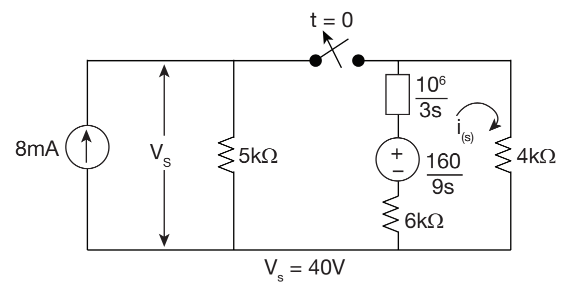
$$i_R = \frac{5}{9}\times 8 = \frac{40}{9}\text{mA}$$

Current through 5KΩ resistor is = $\left(8 - \frac{40}{9}\right)$A

$$= \frac{32}{9}\text{mA}$$

$V_C(0^-) = Vs = 5\times\frac{32}{9}\text{V} = 17.8\text{V}$ Choice (A)

35. At $t > 0$, switch is opened, the network is redrawn in s – domain form.



Capacitor will discharge through 6kΩ and 4kΩ resistors
$I_c = -i_R$
Applying KVL

$$\left(\frac{10^6}{3S} + 6\times10^3 + 4\times10^3\right)I_{(S)} = -\frac{160}{9S}$$

$$i_C(s)\left[\frac{10^6}{3S} + 10^4\right] = \frac{-160}{9S}$$

$$I_C(S) = \frac{-16}{9\left(\frac{100}{3} + S\right)} lA$$

$$I_C(t) = \frac{-16}{9}e^{-\frac{100t}{3}}\text{mA} = -i_R$$

we know that $V_C(t) = \frac{1}{c}\int_o^t i_c(t)\,dt + V_C 10^-$

$$V_C(t) = \left[\frac{10^6}{3}\int_0^t \frac{-16}{9}\times10^{-3}e^{\frac{-100t}{3}}dt\right] + \frac{160}{9}$$

$$= \frac{10^3}{3}\times\frac{-16}{9}\times\frac{3}{-100}e^{\frac{-100t}{3}}+\Big|_o^t + \frac{160}{9}$$

$$= \frac{+160}{3}\left[e^{\frac{-100t}{3}} - 1\right] + \frac{160}{9}$$

$$= \frac{160}{9}e^{\frac{-100t}{3}}\text{V}$$ Choice (B)