NETWORKS TEST 2

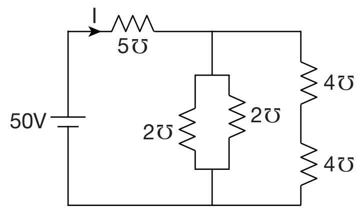
Number of Questions: 35 **Time: 90 min.**

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

1. Twelve 1H inductors are used as edges to form a cube. The inductors between two diagonally opposite corners of the cube is

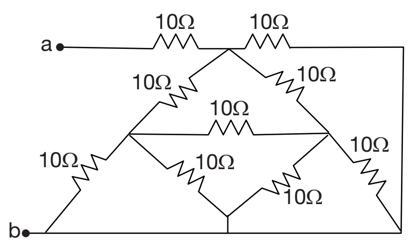
(A) $\frac{5}{6}$H (B) 1H
(C) $\frac{6}{5}$H (D) $\frac{3}{2}$H

2. Determine the current drawn from the battery of the given figure.



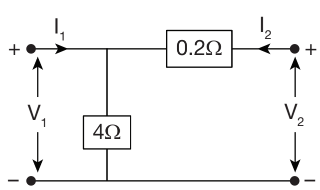
(A) 8.49 A (B) 49.8 A
(C) 36 A (D) 136.36 A

3. Find equivalent resistance between a, and b terminals.



(A) 6.3Ω (B) 4.3Ω
(C) 14.3Ω (D) 16.3Ω

4. Find transition matrix of given 2 port network.



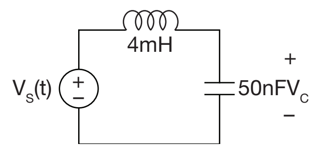
(A) $\begin{bmatrix} 1 & 5 \\ 4 & 21 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & 4 \\ 5 & 21 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 0.2 \\ 0.25 & 1.05 \end{bmatrix}$

(D) Transition matrix does not exist

5. If $V_c(t) = 5 \sin 10^5 t\ V$ in below circuit then $V_S(t)$ would be



(A) 5 sin 10^5t volts (B) –5 sin 10^5t volts
(C) zero (D) –10cos10^5t volts

6. How many number of tie set matrixes are possible for a graph which has N nodes?

(A) $N^{\frac{N}{2}}$ (B) N^{2N}
(C) N^{N-2} (D) N^{N+2}

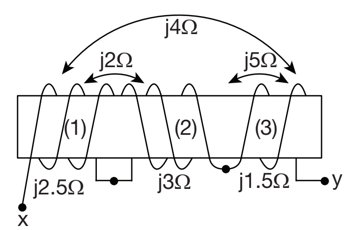
7. Two set of networks are connected in series and each Network contains N number of Resistors each are having $R\Omega$ are connected in parallel then find R – equivalence of Total Network?

(A) $\frac{R}{2n}$ (B) $\frac{2R}{n}$
(C) $\left(\frac{R}{n}\right)^2$ (D) $\sqrt{\frac{R}{n}}$

8. A voltage of $V(t)$ = 8sin314t volts is applied to an inductance of 4mH. Determine the instantaneous power (p)

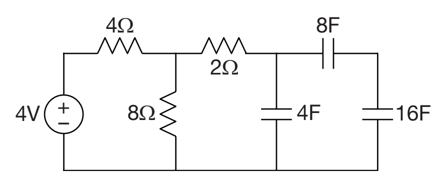
(A) zero (B) – 25.48 sin 628t
(C) –6.37 cos314t (D) – 50.96 cos 314t

9. Find the net inductance of the iron core coupled coils are in series connection.



(A) $j7$ (B) j1H
(C) $j4$ (D) $j13$

10. Find time constant of below circuit



(A) 45.6sec (B) 43.56sec
(C) 53.4sec (D) 54.3sec

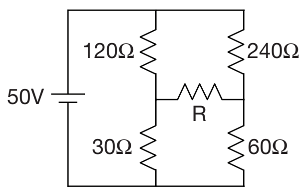
11. A series LCR circuit with $R = 20\Omega$, $|X_L| = |X_c| = 40\Omega$ is connected across an AC supply of 200Vrms. The rms voltage across the inductor is

(A) $200\angle -90°$V (B) $200\angle 90°$V
(C) $400\angle -90°$V (D) $400\angle 90°$V

12. If half power frequencies are given as 5KHz, 8KHz respectively. Then resonance frequency is

(A) 13 KHz (B) 3 KHz
(C) 7 KHz (D) 6.32 KHz

13. Consider the following circuit



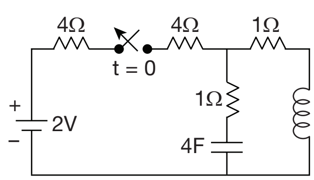
What is the power delivered to resistor R in the above circuit?

(A) 156 watts (B) –156 W
(C) zero (D) 82.52 W

14. The conditions, under which a passive two – port network represented by h if parameters is reciprocal and symmetrical,

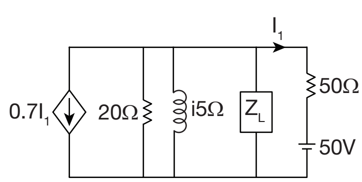
(A) $h_{12} = h_{21}$, $h_{11}h_{22} - h_{12}h_{21} = 1$
(B) $h_{12} = -h_{21}$, $h_{11}h_{22} - h_{12}h_{21} = 1$
(C) $h_{12} = h_{21}$, $h_{11}h_{22} - h_{12}h_{21} = 1$
(D) $h_{12} = -h_{21}$, $h_{12}h_{21} - h_{11}h_{22} = 1$

15. In the circuit shown, the switch is opened at $t = 0$. Then the circuit is



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

16.



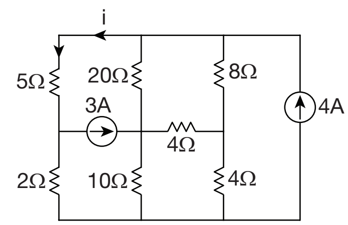
In the given circuit, the maximum power delivered to Z_L if its value is

(A) $(0.084 - j0.2)\Omega$ (B) $(0.084 + j0.2)\Omega$
(C) $(1.785 - j4.25)\Omega$ (D) $(1.785 + j4.25)\Omega$

17. 2 – Two port Networks are connected in series with open circuit impedance parameter matrix is $\begin{bmatrix} 3 & 4 \\ 5 & 2 \end{bmatrix}$ and other two port Network has short circuit admittance parameters matrix $\begin{bmatrix} 5 & 10 \\ 4 & 2 \end{bmatrix}$, then find overal two-port network impendence matrix.

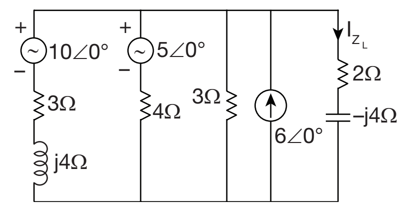
(A) $\begin{bmatrix} 8 & 14 \\ 8 & 4 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & 6 \\ -1 & 0 \end{bmatrix}$
(C) $\begin{bmatrix} 37 & 38 \\ 33 & 54 \end{bmatrix}$ (D) $\begin{bmatrix} 2.933 & 4.333 \\ 5.133 & 1.833 \end{bmatrix}$

18. Find current flowing in 5Ω resistor.



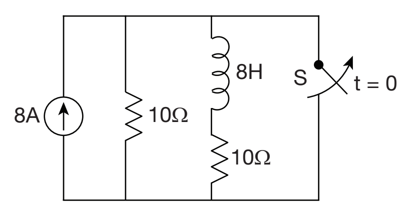
(A) 3.2A (B) 2.32A
(C) 1.25A (D) 6.23A

19. Find the current in load Z_L in below network.



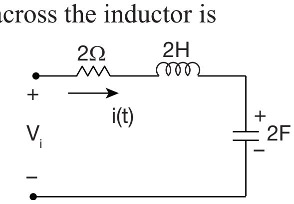
(A) $2.43\angle 60°$ (B) $24.3\angle 3°$
(C) $34.2\angle -30°$ (D) $43.2\angle 60°$

20. Find the voltage across inductor ($t > 0$) where switch is opened at $t = 0$.



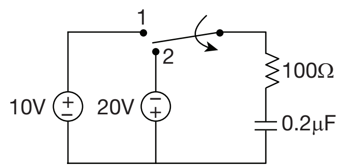
(A) $80\,e^{\frac{-10t}{2}}$ V (B) $80e^{\frac{-4t}{5}}$ V
(C) $80e^{\frac{-5t}{2}}$ V (D) zero

21. The circuit shown below has initial current $i(0^-) = -1$A and initial voltage $V_c(0^-) = 1$V. For unit step response the voltage across the inductor is



(A) $e^{-0.5t}$ (B) $(2 - 0.5t)\,e^{-0.5t}$
(C) $(10 - t)\,e^{-0.5t}$ (D) $10(2.4 - t)\;e^{\frac{-1}{2}t}$

22. Given circuit is attains steady state when the switch at 1 At $t = 0$, the switch is moved to 2. find energy stored across the capacitor at 0.1m sec

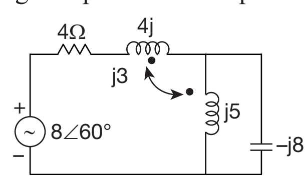


(A) 89.2μJ (B) 392 μJ
(C) 19.79μJ (D) 197 μJ

23. Two coupled coils have $K = 0.7$, $N_1 = 400$ turns, $N_2 = 800$ turns and mutual flux being 0.8 wb, if the primary current be 10A, then find the secondary coil inductance

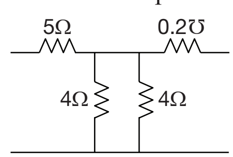
(A) 45.7 H (B) 183 H
(C) 137 H (D) 173 H

24. Find the Voltage drop across the capacitor



(A) $18\angle -90°$ (B) $42.1\angle 15.95°$
(C) $42.1\angle -20.5°$ (D) $21.4\angle +90°$

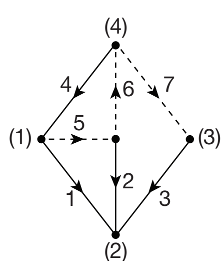
25. Find h parameters for below 2 port network.



(A) $\begin{bmatrix} -6.428 & 35 \\ -35 & 0.142 \end{bmatrix}$ (B) $\begin{bmatrix} 4.8 & 0.285 \\ 1.4 & 0.142 \end{bmatrix}$

(C) $\begin{bmatrix} 4.8 & 1.4 \\ 0.285 & 0.2 \end{bmatrix}$ (D) $\begin{bmatrix} 6.428 & 0.285 \\ -0.285 & 0.142 \end{bmatrix}$

26. Find out which one of the following is tie – set matrix of given graph.



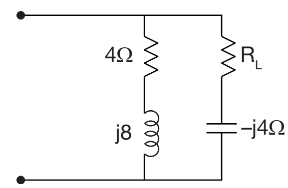
(A) $\begin{bmatrix} -1 & +1 & 0 & 0 & +1 & 0 & 0 \\ +1 & -1 & 0 & +1 & 0 & 1 & 0 \\ -1 & 0 & +1 & -1 & 0 & 0 & 1 \end{bmatrix}$

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

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

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

27. Find the value of R_L in the circuit shown below will make it resonant.

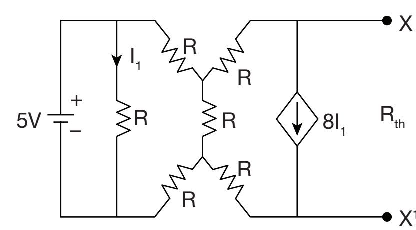


(A) 4.9Ω (B) 24Ω
(C) 5.56Ω (D) None of these

28. A star connector alternator supplies a delta connected load. The impedence of each branch is $(3 + j4)$ Ω. The line voltage is 400 V. Then find reactive power of the load.

(A) 67.8 VAR (B) 57.6 KVAR
(C) 33.255 KVAR (D) 76.8 KVAR

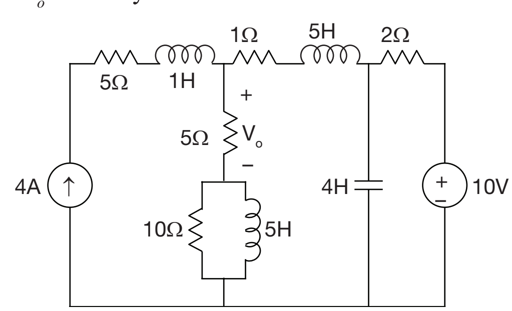
29. Find thevenin's equivalent resistor for given circuit where all resistances are equal to RΩ.



(A) $\frac{3}{8}R$ (B) $\frac{8}{3}R$

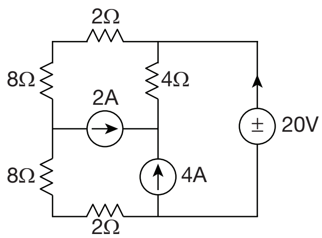
(C) $\frac{R}{4}$ (D) 4 R

30. Find V_o at steady state.



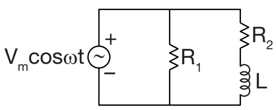
(A) zero V (B) 6.1 V
(C) 4 V (D) 13.75 V

31. Find the power delivered by the voltage source is



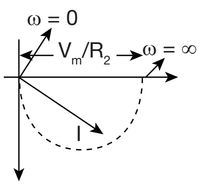
(A) 80 W (B) 20 W
(C) 40 W (D) –80 W

Common data for Questions 32 and 33:

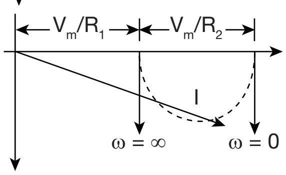


32. In above network ω is varies then locus of total current

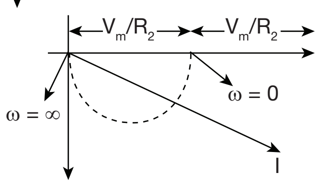
(A)



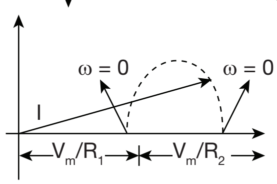
(B)



(C)

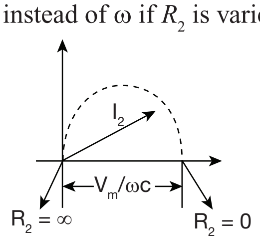


(D)

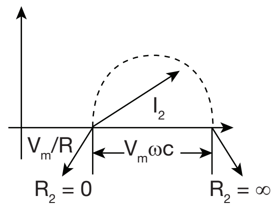


33. In the above circuit inductor is replaced by a capacitor and instead of ω if R_2 is varied then locus of I_2 current.

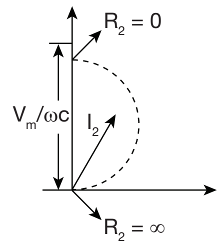
(A)



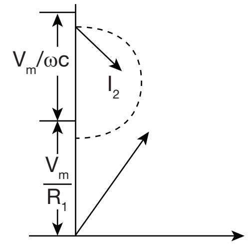
(B)



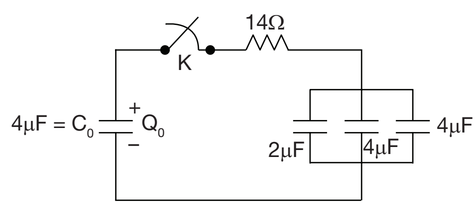
(C)



(D)



Statement for Linked answer Questions 34 and 35:
A 4μF capacitor is initially charged with 600μC. At $t = 0$, the switch is closed.



34. Determine the voltage drop across resistor at $t < T$ where T is time constant.

(A) $600\ e^{-25\times10^3 t}$ V (B) $600\ e^{-14\times10^3 t}$ V
(C) $150\ e^{-25\times10^3 t}$ V (D) $150\ e^{-14\times10^3 t}$ V

35. Find voltage drop across resistor at 40μsec

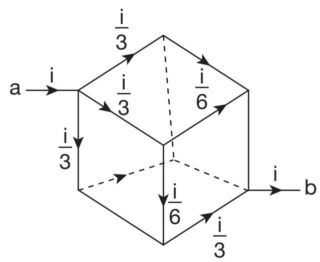
(A) 22 V (B) 339 V
(C) 55.18 V (D) 85 V

Answer Keys

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

Hints and Explanations

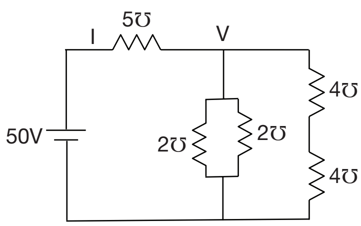
1.

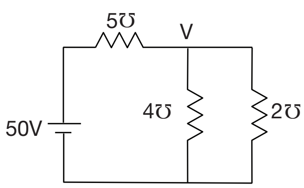


$$V_{ab} = \frac{1}{3}\frac{di}{dt} + \frac{1}{6}\frac{di}{dt} + \frac{1}{3}\frac{di}{dt} = \frac{5}{6}\frac{di}{dt}$$

$\text{Leq} = \frac{5}{6}$ H Choice (A)

2.





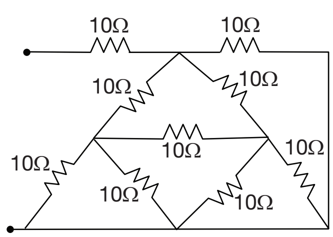
$(V - 50)\,5 + V\,4 + 2\,V = 0$

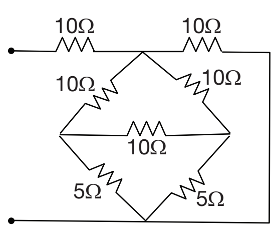
$11\,V = 250$

$V = \frac{250}{11}$

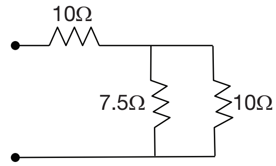
$i = \left(50 - \frac{250}{11}\right) 5 = 136.36$ A Choice (D)

3.



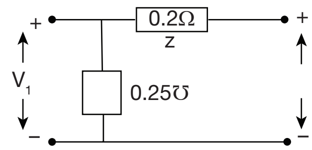


⇒ from bridge balance



$= R_{ab} = 14.28\Omega$ Choice (C)

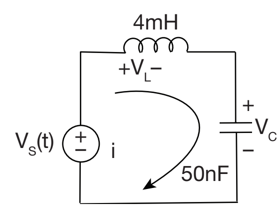
4.



$$\Rightarrow \begin{bmatrix} 1 & z \\ y & zy+1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 1 & 0.2 \\ 0.25 & 1.05 \end{bmatrix}$$ Choice (C)

5. If $V_c\,(t) = 5 \sin 10^5 t\ V$ in below circuit then $Vs\,(t)$



$i_c = i = \frac{Cdv_c}{dt}$ where $(V_c) = 5 \sin 10^5 t$

$= 50 \times 10^{-9} \times 5\ 10^{\,5} \cos 10^5\ t = 25 \cos 10^5 t\ mA$

$V_S = V_L + V_C$

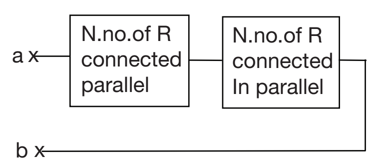
$V_L = L\frac{di}{dt} = 4 \times 10^{-3}\, 25 \times 10^5 \sin 10^5\ t \times 10^{-3}$

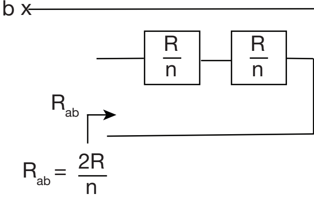
$= -\,10 \sin 10^5\ t$

$V_s = -\,5 \sin 10^5 t$ volts. Choice (B)

6. Choice (C)

7.





$R_{ab} = \frac{2R}{n}$ Choice (B)

8. Current through the inductance is

$I = \frac{1}{L}\int V dt$

$= \frac{10^3 x8}{4}\int \sin 314\ tdt$

$= 2 \times 10^3 \left[\frac{-\cos 314t}{314}\right]$

$= -6.37 \cos 314\ t$ amps

Instantaneous power

$P = Vi = (8 \sin 314\ t)\ (-6.37 \cos 314\ t)$

$= -50.96 \sin 314\ t \cos 314\ t$

$= -25\ .48 \sin 628t$ Choice (B)

9. $L_1 = j2.5\Omega$; $M_{12} = j2\Omega$

$L_2 = j3\Omega$; $M_{23} = j5\Omega$

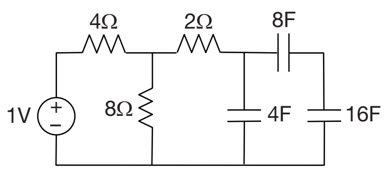
$L_3 = j1.\ 5\Omega$; $M_{13} = j4\ \Omega$

Net inductance is $L_1 + L_2 + L_3 - 2M_{12} - 2M_{23} + 2M_{13}$

$= j(\ 2.5 + 1.5 + 3\ ) - 2 \times j2 - 2\ X j\ 5 + 2\ (j\ 4)$

$= j7 - j4 - j10 + j8 = j1$ Choice (B)

10. Find time constant of below circuit



$T = R_{eq}.c_{eq} = (4//8 + 2)\ (4 + 8//16)$

$= \frac{28}{3}\ \text{x}\ \frac{14}{3} = 43.\ 56$ sec Choice (B)

11. Quality factor $Q = \frac{|x_L|}{R} = \frac{|x_c|}{R} = 2$

rms voltage across inductor

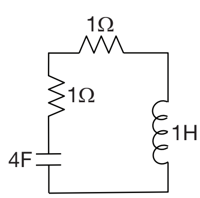
$V_{Lrms} = QV \angle 90° = 400 \angle 90°$ Choice (D)

12. $f_r = \sqrt{f_1\ f_2} = \sqrt{5x8} = 6.32$ KHz Choice (D)

13. It is balanced wheat stone bridge. The current through R is zero so power delivered to R is zero

Choice (C)

15. At $t = 0$ when the switch is opened then the circuit can be redrawn as



$\xi = \frac{R}{2}\sqrt{\frac{C}{L}}$

$R = 1 + 1 = 2\Omega$

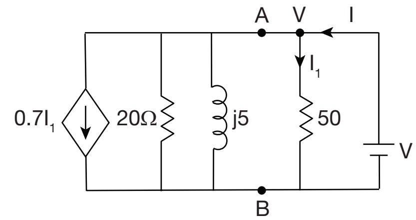
$L = 1$H

$C = 4$F

$\xi = \frac{2}{2}\sqrt{\frac{4}{1}} = 2 > 1$

Choice (C)

16. maximum power delivered to open circuit Z



$I_1 = \frac{V}{50}$

$\Rightarrow$ *KCL* at node V

$\frac{V}{20} + \frac{V}{j5} + \frac{V}{50} + 0.\ 7I_1 = I$

$V\left[\frac{1}{20} + \frac{1}{50} + \frac{0.7}{50} - \frac{j}{5}\right] = I$

$\frac{I}{V} = \left[\frac{1}{20} \times \frac{1.7}{50} - \frac{j}{5}\right] = (0.084 - j\ 0.2)$

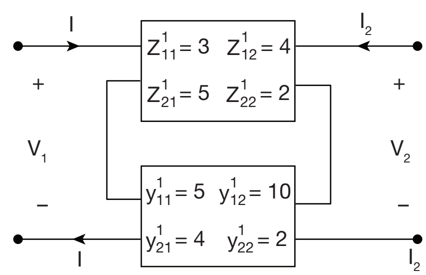
$\frac{V}{I} = Z_{th} = \frac{1}{(0.084 - j0.2)}$

$= (1.785 + j4.25)\Omega$

But $Z_L = Z_{th}$

$Z_L = (1.785 - j4.25)\ \Omega$ Choice (C)

17.



zeq $= [Z_1] + [Z_2]$

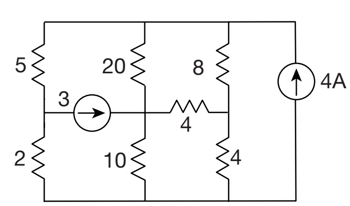
$\rightarrow$ Convert y matrix in to Z – matrix

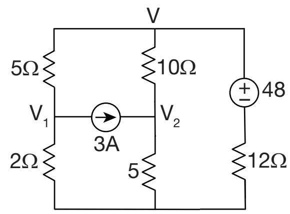
$[Z_2] = [y_2]^{-1} = \begin{bmatrix} 5 & 10 \\ 4 & 2 \end{bmatrix}^{-1} = \begin{bmatrix} 2 & -10 \\ -4 & 5 \end{bmatrix} \times \frac{1}{-30}$

$\Rightarrow \quad Z_{eq} = \begin{bmatrix} 3 & 4 \\ 5 & 2 \end{bmatrix} + \begin{bmatrix} \frac{-1}{15} & \frac{1}{3} \\ \frac{2}{15} & -\frac{1}{6} \end{bmatrix} = \begin{bmatrix} 2.933 & 4.333 \\ 5.133 & 1.833 \end{bmatrix}$

Choice (D)

18.





$\Rightarrow$ *Kcl* at V

$$\frac{V-V_2}{10}+\frac{V-48}{12}+\frac{V-V_1}{5}=0$$

$$23\,V=6\,V_2+12V_1+240$$

$$\text{KCL at } V_1,\ \frac{V_1}{2}+\frac{V_1-V}{5}=3$$

$$7V_1-2V=30 \qquad \rightarrow (2)$$

$$\Rightarrow\ V_1=\frac{30+2V}{7}$$

$$KCL \text{ at } V_2, 3=\frac{V_2-V}{10}+\frac{V_2}{5}$$

$$15V_2-5\,V=150$$

$$3V_2-V=50 \qquad \rightarrow (3)$$

$$\frac{50+V}{3}=V_2$$

$$\Rightarrow\ 23\,V=6\left(\frac{50+V}{3}\right)+12\left(\frac{30+2V}{7}\right)+240$$

$$V\left[23-\frac{6}{3}-\frac{24}{7}\right]=100+\frac{360}{7}+240$$

$$\frac{123V}{7}=\frac{2740}{7}$$

$V = 22.3$

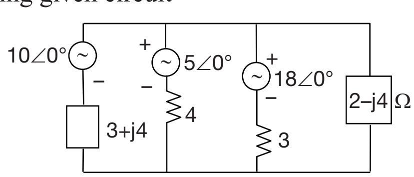
$V_1 = 10.65$

$5i = V - V_1$

$$i=\frac{V-V_1}{5}=2.32\text{ A}$$

Choice (B)

19. Redrawing given circuit



According to millman's theorem $V=\dfrac{V_1Y_1+V_2Y_2+V_3Y_3}{Y_1+Y_2+Y_3}$

$$E=\frac{\frac{10}{3+j4}+\frac{5}{4}+\frac{18}{3}}{\frac{1}{3+j4}+\frac{1}{4}+\frac{1}{3}}=\frac{\frac{10(3-j4)}{5}+\frac{5}{4}+\frac{18}{3}}{\frac{3-j4}{5}+\frac{1}{4}+\frac{1}{3}}$$

$$=\frac{6-j8+6+1.25}{\frac{71}{60}-\frac{j48}{60}}$$

$$=\frac{(13.25-j8)60}{71-j48}$$

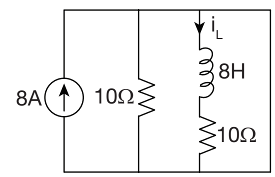
$$=\frac{15.48\angle-31\times 60}{85.7\angle-34}$$

$E = 10.83\angle -3°$

$$i_{ZL}=\frac{E}{Z_L}=\frac{10.88\angle-3°}{2-j4}=\frac{10.88\angle-3°}{4.47\angle-63°}=2.43\angle 60°A$$

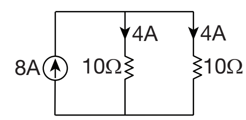
Choice (A)

20.



$i_L = 0$ at $t = 0^-$

at $t \Rightarrow \infty$



$i_L = 4\text{A}$

$$T=\frac{L}{R}=\frac{8}{20}=0.4$$

$$i_L=4+(0-4)\ e^{\frac{-t}{0.4}}=4\left(1-e^{\frac{-5t}{2}}\right)$$

$$V_L=\frac{Ldi_L}{dt}\text{ volts.}=8\times 4\times\frac{5}{2}e^{\frac{-5t}{2}}$$

$V_L = 80\,e^{\frac{-5t}{2}}$ V

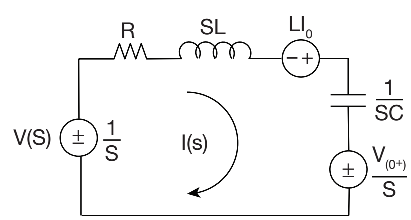
Choice (C)

21. From the given data

$I(0^-) = -1$A and $V_c(0^-) = 1$V.

$V_i(t) = u(t)$ volts.

Converting the given circuit into S-Domain. It becomes.



Applying *KVL*

$$\therefore\ \frac{1}{S}=\left(R+SL+\frac{1}{SC}\right)I(S)-L\,I_0+\frac{V_0}{s}$$

$$\frac{1}{S}=\left(2+2s+\frac{1}{2s}\right)I(s)+2+\frac{1}{s}$$

$$I(s)=\frac{-2\times 2s}{4s^2+4s+1}=\frac{-s}{s^2+s+\frac{1}{4}}$$

$$I(s) = \frac{-s}{\left(s+\frac{1}{2}\right)^2}$$

$$V_L = L.\frac{di}{dt(t)}$$

$$I(s) = \frac{A}{s+\frac{1}{2}} + \frac{B}{\left(s+\frac{1}{2}\right)^2}$$

$$B \text{ at } s = \frac{-1}{2}$$

$$B = \frac{1}{2}.$$

$$-s = A\left(s+\left(s+\frac{1}{2}\right)\right) + B.$$

Compare both sides S^1 terms.
$A = -1$.

$$\therefore \quad I(s) = \frac{-1}{(s+2)} + \frac{\left(\frac{1}{2}\right)}{\left(s+\frac{1}{2}\right)}$$

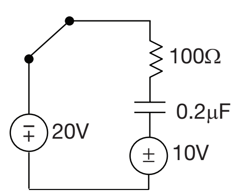
$$I(t) = \left\{-e^{\frac{-1}{2t}} + \frac{1}{2}te^{\frac{-t}{2}}\right\}\text{wts.}$$

$$V_{2(t)} = L.\frac{di(t)}{dt} = 2\left\{\frac{d}{dt}\left\{-e^{-\frac{1}{2}t}\right\} + \frac{d}{dt}\left\{t.e^{-\frac{1}{2}t}\right\}\right\}$$

$$= e^{-\frac{1}{2}t} + t\left\{-\frac{1}{2}.e^{-\frac{1}{2}t}\right\} + e^{\frac{-t}{2}}.1$$

$V_L(t) = (2.e^{-0.5t} - 0.5t.\ e^{-0.5t})$
$V_L(t) = \{2 - 0.5t\}.\ e^{-0.5t}.\ V(t).$ Choice (B)

22. From the given data $V_c(0^+) = 10V_C.(0^-)$ for $t \geq 0$. the circuit becomes.



$V_c(\infty) = 30V.$
$\tau = RC = 100 \times 0.2 \times 10^{-6} = 20\ \mu$ sec
$V_c(t) = V_c(\infty) + \{V_c(0^+) - V_c(\infty)\}.\ e^{-t/\tau}$ volts
$= 30 - 20.\ e^{-50\times10^3 t}$ volts

at $t = 0.1$in sec.
$V_c = 30 - 20.\ e^{-5} = 29.86$

$$E = \frac{1}{2}CV^2$$

$$= \frac{1}{2} \times 0.2 \times 10^{-6} \times 892 \approx 89.2\ \mu J$$ Choice (A)

23. Let ϕ_1 = primary flux ; ϕ_{12} mutual flux, K co-efficient of coupling $I_1 = 10$ A
$\phi_{12} = K\phi \Rightarrow 0.8 = 0.7\ \phi_1$
$\Rightarrow \quad \phi_1 = 1.1428$

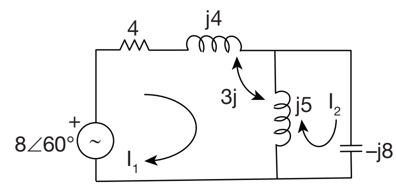
$$L_1 = = \frac{N_1\varphi_1}{I_1} = \frac{400\times1.1428}{10} = 45.7\text{H}$$

$$M = K\sqrt{L_1L_2}$$

$$N_2 = \frac{\varphi_{12}}{I_1} = M = 800\times\frac{0.8}{10}$$

$\Rightarrow \quad 64 = 0.7\sqrt{45.7L_2}$
$\Rightarrow \quad L_2 = 183$H Choice (B)

24.



Applying KVL in loop 1
$8\angle60° = 4I_1 + j4I_1 + j5(I_1 - I_2) - j_3(I_1 - I_2)$
$8\angle60° = I_1(4 + j6) - j2I_2$
Apply KVL in loop 2
$j5(I_2 - I_1) - j8\ I_2 - j3\ I_1 = 0$
$\Rightarrow \quad I_1 8j = 3j\ I_2$

$$I_1 = \frac{3}{8}I_2$$

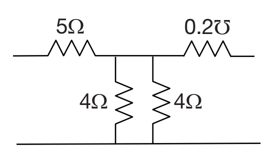
$$\Rightarrow \quad 8\angle60° = I_2\left(\frac{3}{8}(4+j6) - 2j\right)$$

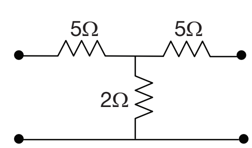
$$8\angle60°\ I_2\left(\frac{3}{2} - \frac{j}{4}\right)$$

$$I_2 = \frac{8\angle60°}{1.52\angle-9.5°} = 5.263\angle69.5°$$

Drop across capacitors is $(-j8)\ x\ (5.263\angle69.5°)$
$= 8\angle-90° \times 5.263\angle69.5$
$= 42.1\angle-20.5°$ Choice (C)

25.





Z matrix is $\begin{bmatrix} 7 & 2 \\ 2 & 7 \end{bmatrix}$

Converting zmatrix in h parameter

$$h_{11} = \frac{Z_{11}Z_{22} - Z_{12}Z_{21}}{Z_{22}} = 6.428\Omega$$

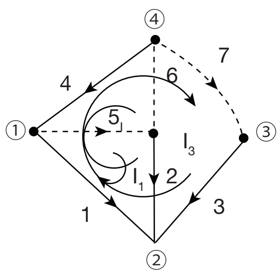
$$h_{12} = \frac{Z_{12}}{Z_{22}} = \frac{2}{7} = 0.285$$

$$h_{21} = \frac{-Z_{12}}{Z_{22}} = \frac{-2}{7} = 0.285$$

$$h_{22} = \frac{1}{Z_{22}} = \frac{1}{7} = 0.142$$

$\Rightarrow$ h matrix is $\begin{bmatrix} 6.428 & 0.285 \\ -0.285 & 0.142 \end{bmatrix}$ Choice (D)

26.



Tie – set 1 (loop current I_1) $\rightarrow$ formed by twigs 1 & 2 with link 5
Tie – set 2 (loop current I_2) $\rightarrow$ twigs 1, 2, 4 with link 6
Tie – set 3 (loop current I_3) $\rightarrow$ twigs 3, 1, 4, & link 7

$$\begin{matrix} I_1 \\ I_2 \\ I_3 \end{matrix}\begin{bmatrix} -1 & +1 & 0 & 0 & +1 & 0 & 0 \\ +1 & -1 & 0 & +1 & 0 & 1 & 0 \\ -1 & 0 & +1 & -1 & 0 & 0 & 1 \end{bmatrix}$$ Choice (A)

27. At resonant frequency imaginary part of Total impedance or admittance must be zero

$$Y_L = \frac{1}{4 + j8} = \frac{4 - j8}{80} = \frac{1 - 2j}{20}$$

$$Y_C = \frac{1}{R_L - j4} = \frac{R_L + j4}{R_L^2 + 16}$$

Thus imaginary part of $Y_t = y_c + y_L$ must be zero

$$\frac{-2j}{20} + \frac{j4}{R_2^2 + 16} = 0$$

$$\frac{4}{R_2^2 + 16} = \frac{2}{20}$$

$$40 = R_L^2 + 16$$

$$R_L^2 = 24$$

$R_L = \sqrt{24} = 4.9\Omega$ Choice (A)

28. $Z_{ph} = 3 + j4 = 5\angle 53.13°\ \Omega$
$V_L = 400$ V

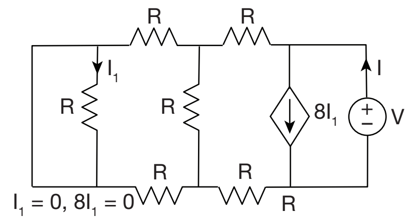
$$I_{ph} = \frac{400}{5} = 80 \text{ A}$$

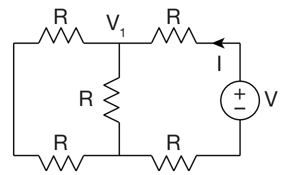
$I_L = 80\sqrt{3}$ A

Power factor of load = $\cos\phi = \frac{R_{ph}}{Z_{ph}} = \frac{3}{5} = 0.6$lag

Reactive power of load = $\sqrt{3}\, V_L I_L \sin\phi$
$= \sqrt{3} \times 400 \times \sqrt{3} \times 80 \times 0.8$
= 76.8 KVAR Choice (D)

29. To find thevenins Resistor, short circuit voltage source





$$\frac{V_1}{2R} + \frac{V_1}{R} + \frac{V_1 - V}{2R} = 0 \text{ and}$$

$$\frac{V - V_1}{2R} = I \qquad \text{------- (i)}$$

$$V_1\left[\frac{1}{2R} + \frac{1}{R} + \frac{1}{2R}\right] = \frac{V}{2R}$$

$$V_1\left[\frac{2}{R}\right] = \frac{1}{2R}$$

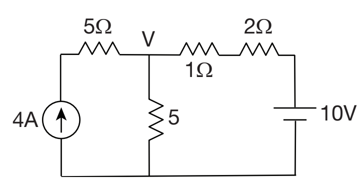
$$\Rightarrow \quad V_1 = \frac{V}{4} \qquad \text{---------(ii)}$$

Sub (ii) in (i)

$$\frac{V - \frac{V}{4}}{2R} = I; \quad \frac{3V}{I} = 8R$$

$\Rightarrow \frac{V}{I} = \frac{8}{3}R = R_{th}$ Choice (B)

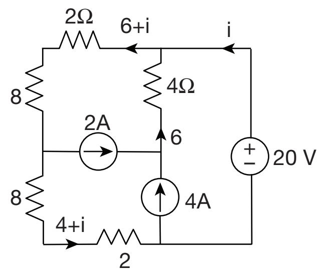
30. At steady state inductor is short circuited and capacitor is open circuited so redrawing given circuit



$$4 = \frac{V}{5} + \frac{V - 10}{3}$$

$V = \frac{110}{8} = 13.75$ Choice (D)

31. Given Network is



Apply *KVL*

20 =10 (6+ i) + 10 (4 + i)

20 =10 [10 + 2i]

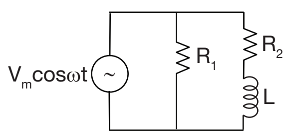
2 = 10 + 2i

⇒ 2 i = – 8

i = – 4

Power = 20 x –4 = –80 W Choice (D)

32.

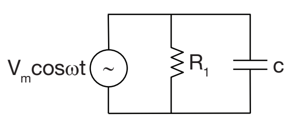


$I = I_1 + I_2$

$$= \frac{V_m\angle 0°}{R_1} + \frac{V_m\angle 0°}{R_2 + j\omega L}$$

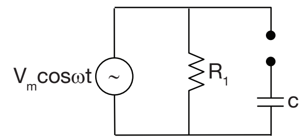
$$\frac{V_m\angle 0°}{R_1} + \frac{V_m}{\sqrt{R^2 + \omega^2\ c^2}} - \tan^{-1}\left(\frac{\omega L}{R}\right)$$ Choice (B)

33.



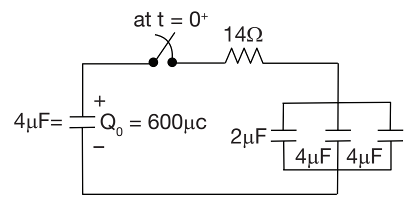
If $R_2 = 0$

$$I_2 = \frac{E_m}{\frac{1}{\omega C}}\angle -90° = E_m\omega C\angle -90°$$



If $R_2 = \infty$ $I_2 = 0$ Choice (C)

34. Given circuit is



$T = RC_{eq}$

$= 14\ (10//4)\ x\ 10^{-6}$

$= 14\ x\ \frac{20}{7}\ x\ 10^{-6}$

= 40 μ sec

The initial voltage V_0 across capacitor c_o is given as

$$V_0 = \frac{Q_0}{C_0}$$

$$= \frac{600X10^{-6}}{4X10^{-6}}$$

= 150 V

→ With closing of k_1 the capacitor C_o will start discharging, and at $t = 0^+$ there will be no voltage across 2μF, 4μF, 4μF, because at $t = 0^-$ switch is opened. So the entire voltage drop across R at $t = 0^+$ time

$V_R = V_0 e^{-t/RC}$

$= 150\ e^{\frac{-t}{40x10^{-6}}}$

$= 150\ e^{-25\ x\ 10^3 t}$ Choice (C)

35. $V_R = 150\ e^{-25\times10^3\times40\times10^{-6}}$

$= 150\ e^{-1} = 55.18$ Choice (C)