## NETWORKS TEST 4

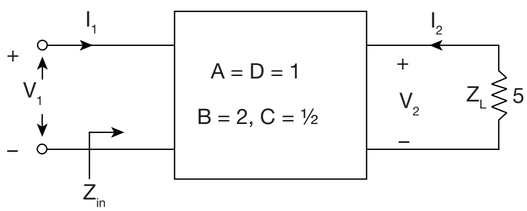
**Number of Questions: 25** **Time: 60 min.**

***Directions for questions 1 to 25:*** Select the correct alternative from the given choices.

**1.** Calculate the average power absorbed by an impedance $Z = (25 - j50)\ \Omega$, when a voltage $V = 120^o \angle 0^o\ V$ is applied across it.

(A) 29W (B) 32W
(C) 115.2W (D) None

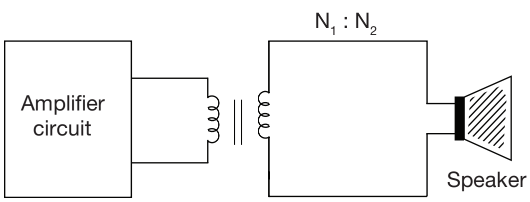
**2.** Consider the circuit shown in figure




The input impedance $Z_{in}$ is _________.

(A) 3.5 Ω (B) 2 Ω
(C) 7 Ω (D) 5 Ω

**3.** The ideal transformer in figure is used to match the amplifier circuit to the loud speaker to achieve maximum power transfer.



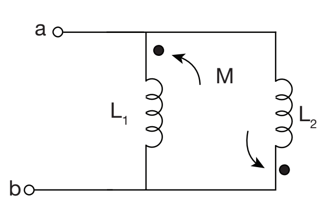

If the output impedance of the amplifier is 192 Ω and the internal impedance of the speaker is 48 Ω. Then the required turns ratio $(N_1 : N_2)$ is ________

(A) 2 : 1 (B) 1 : 2
(C) 1 : 3 (D) 1 : 4

**4.** The coefficient of coupling for two coils having $L_1$ = 2H, $L_2$ = 8H and $M$ = 2H is

(A) 2 (B) 0.25
(C) 4 (D) 0.5

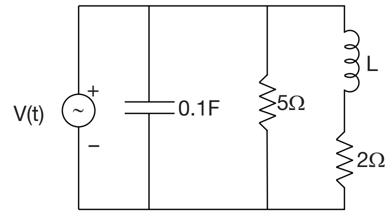
**5.**




Two coils are mutually coupled with $L_1$ = 10H and $L_2$ = 40H and $k$ = 0.5. Then the maximum possible equivalent inductance in between the terminals '*a*' and '*b*' is _______

(A) 30H (B) 4.28H
(C) 5H (D) 8H

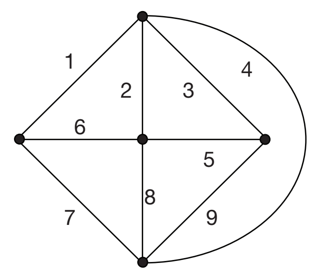
**6.** Consider the parallel RLC circuit shown in below.




If resonant frequency $\omega_o$ = 2 rad/sec, then the value of $L$ is ______

(A) 0.5H (B) 2H
(C) A and B (D) 4H

**7.** Consider the graph shown in below.

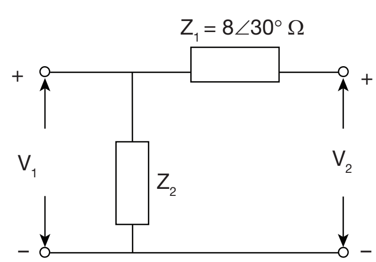



Match List – I with List – II:

| List – I | | List – II | |
|---|---|---|---|
| *P* | Links | *a* | 2, 5, 6, 8 |
| *Q* | f-loops | *b* | 1, 4, 5, 9 |
| *R* | twigs | *c* | 1, 2, 3, 4 |
| *S* | f-cut set | *d* | 2, 3, 6, 7, 8 |
| | | *e* | 3, 4, 9 |

(A) $P - d, Q - e, R - c, S - a$
(B) $P - c, Q - d, R - a, S - e$
(C) $P - c, Q - d, R - b, S - e$
(D) $P - d, Q - e, R - b, S - a$

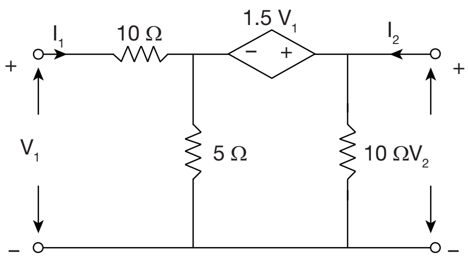
**8.** Two networks are connected in cascade as shown in the figure, with the usual notations the equivalent $A$, $B$, $C$ and $D$ constants are obtained. Given that $D = 3 \angle 0^o$, the value of $Z_2$ = is _____.



(A) $0.25\angle{-30°}\ \Omega$ (B) $2\angle{-30°}\ \Omega$
(C) $4\angle 30°\ \Omega$ (D) $4\angle{-30°}\ \Omega$

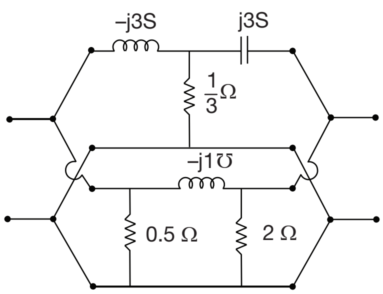
**9.** The resonant frequency of an *RLC* series circuit is 1.5 MHz with the resonating capacitor of 15 pF. The bandwidth is 10 kHz. Then the effective values of the resistor *R* is ________.
(A) 92 Ω (B) 1.25 kΩ
(C) 47.15 Ω (D) 4.25 kΩ

**10.**



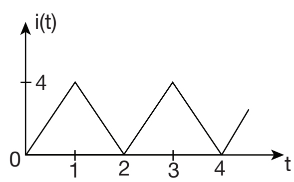

The *h*-parameters ($h_{11}$ and $h_{21}$) of the circuit is ________
(A) 4 Ω and –2.2 (B) 4 Ω and 5/11
(C) 2.5 Ω and –2.2 (D) $\frac{11}{5}$ Ω and 1.2

**11.** Consider the circuit shown in below



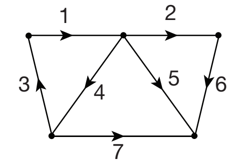

The y-parameters of the port network would be _______
(A) $\begin{bmatrix} 5-j4 & -3+j1 \\ -3+j1 & 3.5+j2 \end{bmatrix}$℧ (B) $\begin{bmatrix} 5+j4 & 3+j1 \\ 3+j1 & 3+j2 \end{bmatrix}$℧
(C) $\begin{bmatrix} 5-j4 & -3+j1 \\ -3-j1 & 3.5+j2 \end{bmatrix}$ (D) None of these

**12.** The RMS value of the current wave form *i*(*t*) is _____.




(A) $\frac{4}{\sqrt{3}\,A}$ (B) $\frac{2}{\sqrt{3}A}$
(C) $\frac{\sqrt{3}}{2A}$ (D) $4\sqrt{3}$ A

**13.** Determine the fundamental cutset matrix for the given directed graph.




(Consider tree branches 3, 4, 5 and 6)

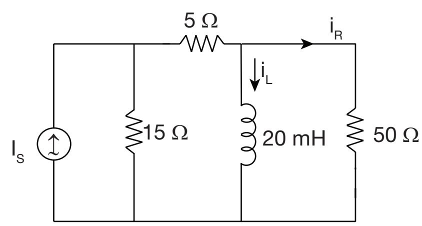
(A) $\begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 \end{bmatrix}$

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

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

(D) None of these

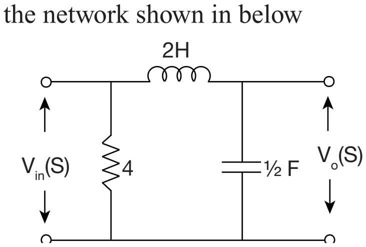
**14.** If $I_S = 5 \cos 500\, t$ A, In the circuit shown in figure




Then the circuit $i_L(t)$ is _____
(A) 2 cos (500*t* – 26.56°) A
(B) 0.8 sin (500*t* + 26°) A
(C) 5 cos (500*t* + 30°) A
(D) None of these

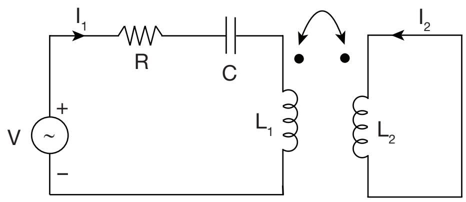
**15.** Two magnetically uncoupled inductive coils have quality factors 10 and 15 at the chosen operating frequency. Their respective resistances are 5 Ω and 20 Ω. When connected in series, their effective *Q*-factor at the same operating frequency is ________.
(A) 14 (B) 20
(C) 6 (D) 30

**16.** Consider the network shown in below




The impulse response *h*(*t*) is ___________
(A) cos *t* (B) sin *t*
(C) 2 sin 2*t* (D) 1/2 cos 2*t*

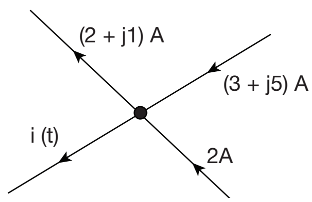
**17.** Determine the resonance frequency of the circuit shown in figure is ______.




Consider $R$ = 15 Ω, $C$ = 3 μF and $L_1$ = 40 mH, $L_2$ = 10 mH and $M$ = 5 mH.

(A) 500 Hz (B) 474.5 Hz
(C) 375 Hz (D) 2.98 kHz

**18.** In the circuit shown below, if $f$ = 50 Hz, then the current $i(t)$ is ________



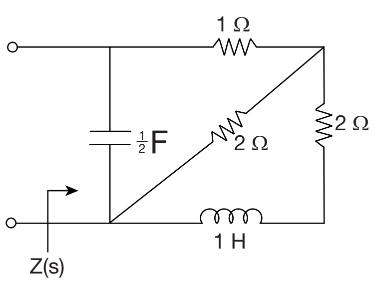

(A) 5 cos(100$t$ + 53.13°) A
(B) 5 cos(100π$t$ + 53.13°) A
(C) 25 cos(50$t$ + 36°) A
(D) 2.5 sin(100π$t$ + 36°) A

**19.** The current through voltage across the 150 mF capacitor is given by $I_c(s) = \frac{2s+3}{(s+2)}$.

The steady state voltage across capacitor is ______

(A) 0 (B) 10V
(C) ∞ (D) 6.7V

**20.** Consider the circuit shown in below.

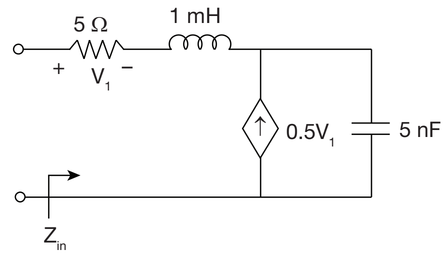



The value of $Z(s)$ is ________

(A) $\frac{3(8+2s)}{3s^2+10s+8}$ (B) $\frac{(8+3s)}{s^2+10s+8}$

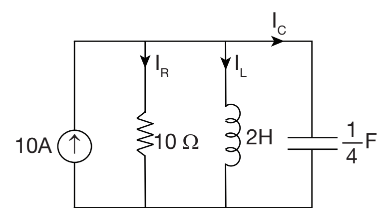
(C) $\frac{2(8+3s)}{3s^2+10s+8}$ (D) $\frac{2(8+3s)}{s^2+10s+8}$

**21.** For the circuit shown below the resonant frequency $f_o$ is _____.




(A) 125 kHz (B) 150 kHz
(C) 830 kHz (D) 133 kHz

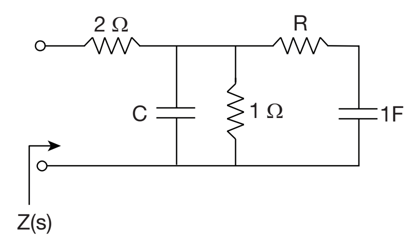
**22.**




At resonance $I_C$ and $I_L$ would be

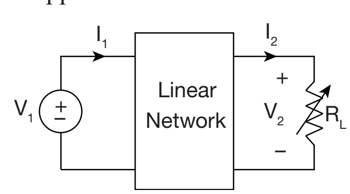
(A) $25\sqrt{2}\angle 90^\circ$A, $25\sqrt{2}\angle{-90^\circ}$ A
(B) $2\sqrt{2}\angle 90^\circ$ A, $2\sqrt{2}\angle{-90^\circ}$ A
(C) $25\sqrt{2}\angle{-90^\circ}$A, $25\sqrt{2}\angle 90^\circ$ A
(D) $j2\sqrt{2}$ A, $-j2\sqrt{2}$ A

**23.** The network realization of $RC$ impedance function, $Z(s) = \frac{2s^2+7s+3}{s^2+3s+1}$, is as shown below what are the values of $R$ and $C$?



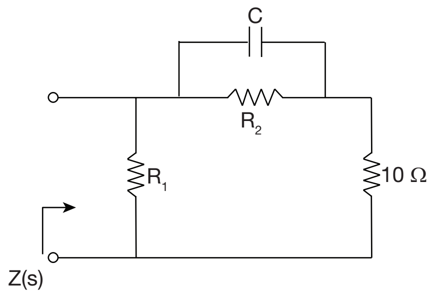

(A) 1 Ω, 1F (B) 2 Ω, 0.5F
(C) 1 Ω, 0.5F (D) 2 Ω, 2F

**24.** In a linear network, a 1 Ω resistor consumes a power of 4 W, when voltage source of 4 V is applied to the circuit and 16 W when the voltage source is replaced by an 8 V source the power consumed by the 1 Ω resistor when 10 V is applied will be




(A) 25W (B) 20W
(C) 18W (D) 30W

**25.** Consider the following circuit.




In the above circuit $Z(s) = 6$ as $s \to \infty$ and $Z(s) = 5\ \Omega$ as $s \to 0$. What are the values of $R_1$ and $R_2$?
(A) 5 Ω and 10 Ω
(B) 10 Ω and 5 Ω
(C) 15 Ω and 5 Ω
(D) 10 Ω and 7.5 Ω

## Answer Keys

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** C | **2.** B | **3.** A | **4.** D | **5.** B | **6.** C | **7.** D | **8.** C | **9.** C | **10.** A |
| **11.** A | **12.** A | **13.** B | **14.** A | **15.** A | **16.** B | **17.** B | **18.** B | **19.** B | **20.** C |
| **21.** D | **22.** A | **23.** A | **24.** A | **25.** B | | | | | |

## Hints and Explanations

**1.** $P = V_{rms.} I_{rms}.\cos\phi$

$$P = \frac{1}{2} \times V_m.I_m.\cos(\theta_v - \theta_i)$$

$$I_{rms} = \frac{V}{Z}\ \frac{120\angle 0^o}{25(1-j2)} = 2.146\angle 63.43^o\ .\text{Amp}$$

$$P = \frac{1}{2} \times 120 \times 2.146 \times 2\cos(0 - 63.43^o)\ \text{Watts}$$

= 115.2 Watts Choice (C)

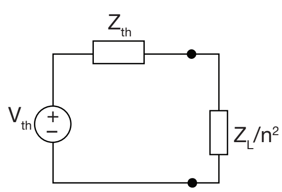
**2.** We know $T$-parameters are defined interms of
$V_1 = AV_2 - BI_2$
$I_1 = CV_2 - DI_2$

$$Z_{in} = \frac{V_1}{I_1} = \frac{AV_2 - BI_2}{CV_2 - DI_2}$$

But $V_2 = -Z_L I_2$

$$\therefore Z_{in} = \frac{AZ_L + B}{CZ_L + D} = \frac{5+2}{2.5+1} = \frac{7}{3.5} = 2\ \Omega$$ Choice (B)

3. Replace the amplifier circuit with the thevenins equivalent circuit.




$\therefore\ Z_{th} = 192\ \Omega$ and $\dfrac{Z_L}{n^2} = 48\Omega$

$Z_{th} = \dfrac{Z_L}{n^2}$ for max power

Where $n = \dfrac{N_2}{N_1}$

We know $R_s = \dfrac{R_L}{n^2}$

$$n^2 = \frac{48}{192} = \frac{1}{4}$$

$N_1 : N_2 = 2:1$ Choice (A)

**4.** We know

$$k = \frac{M}{\sqrt{L_1 L_2}} = \frac{2}{4} = \frac{1}{2}$$

$k = 0.5$ Choice (D)

**5.** $M = K\sqrt{L_1 L_2}$

$$= 0.5\sqrt{10 \times 40} = 10\text{H}$$

For parallel opposing configuration

$$L_{eq} = \frac{L_1 L_2 - M^2}{L_1 + L_2 + 2M}$$

$$= \frac{400 - 100}{50 + 20} = \frac{300}{70} = 4.28\text{H}$$ Choice (B)

**6.** $Y = 0.2 + j\omega(0.1) + \dfrac{1}{2 + j\omega L}$

$$Y = 0.2 + j\omega(0.1) + \frac{2 - j\omega L}{4 + (\omega_o L)^2}$$

At resonance Img $\{Y\} = 0$
$\omega = \omega_o$

$$\omega_o(0.1) = \frac{\omega_o L}{4 + (\omega_o L)^2}$$

$4 + (\omega_o L)^2 = 10\ L$
But given $\omega_o = 2$ r/s
$4\ L^2 = 10\ L - 4$

$2L^2 - 5L + 2 = 0$
$2L^2 - 4L - L + 2 = 0$
$2L\{L - 2\} - 1\{L - 2\} = 0$
$L = 2$ and $L = ½$ Choice (C)

**7.** Tree branches are called twigs
∴ no. of twigs $= N - 1$
Here $N = 5$
∴ Twigs = 4
Select the twigs, without forming closed loop.
Co-tree branches are called links
∴ Total branches = Twigs + links
$f$ – loops: It consists only one link and one or more than one twigs
$f$-cut set: It is a removal of one tree branch at a time.
It consists only one tree branch and others links.
Choice (D)

**8.** $[T] = \begin{bmatrix} 1 & Z_1 \\ \frac{1}{Z_2} & 1+\frac{Z_1}{Z_2} \end{bmatrix}$

$\therefore D = 1+\frac{Z_1}{Z_2}$

$2 = \frac{Z_1}{Z_2}$

$Z_2 = \frac{Z_1}{2} = 4\ \angle 30^o\ \Omega$ Choice (C)

**9.** $f_o = 1.5$ MHz
$BW = 10$ kHz

$Q = \frac{f_o}{BW} = \frac{1.5\times 10^6}{10^4} = 150$

We know $Q = \frac{|X_C|}{R}$

$R = \frac{1}{2\pi f_o C \times Q}$

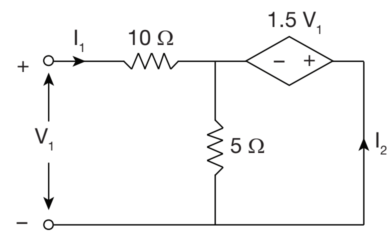
$R = \frac{10^{12}}{2\pi\times 1.5\times 10^6\times 15\times 150}$

$R = \frac{10^6}{2\pi\times 1.5\times 15\times 150}$

$R = 47.15\ \Omega$ Choice (C)

**10.** h-parameters are defined interms of
$V_1 = h_{11} I_1 + h_{12} V_2$
$I_2 = h_{21} I_1 + h_{22} V_2$
Let $V_2 = 0$

$h_{11} = \frac{V_1}{I_1}$



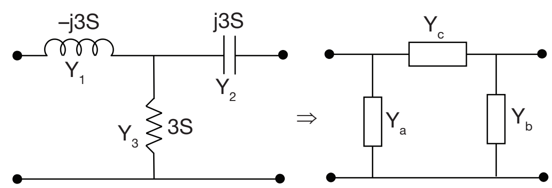

$V_1 = 10 I_1 - 1.5 V_1$
$2.5 V_1 = 10 I_1$
$V_1/I_1 = 4\ \Omega$

$I_1 + I_2 = \frac{-1.5V_1}{5}$

But $V_1 = 4 I_1$
$I_1 + I_2 = -0.3 \times 4 I_1$
$2.2 I_1 = -I_2$

$\frac{I_2}{I_1} = -2.2$ Choice (A)

**11.** Two networks $N_1$ and $N_2$ are connected in parallel
∴ $y = [Y_1] + [Y_2]$




$y - \Delta$ conversion

$y_a = y_1 + y_3 + \frac{y_1 y_3}{y_2}$

$= (-j3 + 3) + \frac{(-j3)(3)}{j3} = -j3$ S

$Y_b = Y_2 + Y_3 + \frac{y_2 . y_3}{y_1}$

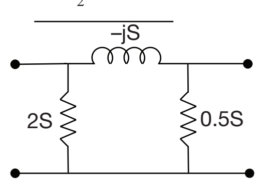
$= (j3 + 3) + \frac{(j3)(3)}{-j3} = j3$ S

$y_c = Y_1 + Y_2 + \frac{y_1 y_2}{y_3} = 0 + 3$ S

$y_c = 3$ S

$[Y]_1 = \begin{bmatrix} y_a + y_c & -y_c \\ -y_c & y_b + y_c \end{bmatrix} = \begin{bmatrix} (3-j3) & -3 \\ -3 & 3+j3 \end{bmatrix}$ ℧

and second network $N_2$ is



$$[Y]_2 = \begin{bmatrix} 2-j1 & j1 \\ j1 & 0.5-j1 \end{bmatrix} ℧$$

$[Y] = [y_1] + [y_2]$

$$= \begin{bmatrix} 3+2-j3-j1 & -3+j1 \\ -3+j1 & 3+0.5+j3-j1 \end{bmatrix}$$

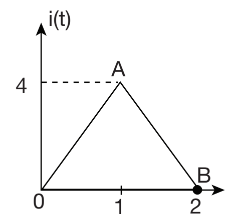
$$= \begin{bmatrix} 5-j4 & -3+j1 \\ -3+j1 & 3.5+j2 \end{bmatrix} ℧$$

Choice (A)

**12.** $I_{rms} = \sqrt{\frac{1}{T}\int_0^T i^2(t).dt}$

Consider one period of $i(t)$

$T = 2$




$0(0, 0)$ $A(1, 4)$

$$i(t) = \left(\frac{4-0}{1-0}\right)(t-0)$$

$i(t) = 4t$; for $0 < t < 1$

for $A$ to $B$ straight line

$A(1, 4)$ $B(2, 0)$

$$i(t) - 4 = \left(\frac{0-4}{2-1}\right)(t-1)$$

$i(t) = -4t + 8$; $1 < t < 2$

$$\therefore I_{rms}^2 = \frac{1}{2}\left[\int_0^1 i^2(t)\,dt + \int_1^2 i^2(t).dt\right]$$

$$= \frac{1}{2}\left[\int_0^1 16t^2\,dt + \int_1^2 (-4t+8)^2\,dt\right]$$

$$= \frac{1}{2}\times\frac{16}{3}[1] + \frac{16}{2}\left[\int_1^2 (t^2-4t+4).dt\right]$$

$$I_{rms}^2 = 2.666 + 8\left[\frac{t^3}{3} - 2t^2 + 4t\right]_1^2$$

$$= 2.666 + 8\left[\frac{7}{3} - 2(3) + 4\right]$$

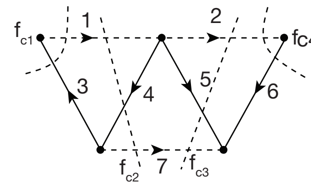
$$= \left(\frac{8}{3} + \frac{8}{3}\right)\text{Amp}$$

$$I_{rms}^2 = \frac{16}{3}$$

$$I_{rms} = \frac{4}{\sqrt{3}}\text{ Amp}$$

Choice (A)

**13.** Number of cut sets = Number of twigs = 4




$\therefore$ Cut set nothing but removal of tree branch.

Consider the twig direction is $+ve$

$f_{c_1} \to 1, 3$

$f_{c_2} \to 1, 4, 7$

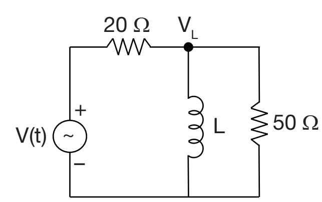
$f_{c_3} \to 2, 5, 7$

$f_{c_4} \to 2, 6$

| | **Branches** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Cut sets** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| $f_{c1}$ | –1 | 0 | +1 | 0 | 0 | 0 | 0 |
| $f_{c2}$ | –1 | 0 | 0 | +1 | 0 | 0 | –1 |
| $f_{c3}$ | 0 | +1 | 0 | 0 | +1 | 0 | +1 |
| $f_{c4}$ | 0 | –1 | 0 | 0 | 0 | 1 | 0 |

Choice (B)

**14.**




$V(t) = 15\,i(t) = 75\cos 500t$ V.

$\omega = 500$

$$\frac{V_L - V(t)}{20} + \frac{V_L}{j\omega L} + \frac{V(t)}{50} = 0$$

$5[V_L - V(t)] + (-j10V_L) + 2V(t) = 0$

$5V_L - 5V(t) - j10\,V_L + 2\,V(t) = 0$

$V_L\,(5 - j10) = 3V(t)$

$$V_L = \frac{3}{5}\frac{V(t)}{(1-j2)}$$

$$i_L(t) = \frac{V_L}{X_L} = \frac{3}{5}\times\frac{75\cos 500t}{(1-j2)(j10)}$$

$$i_L(t) = \frac{4.5\cos 500t}{(2+j1)}$$

$i_L(t) = 2\cos(500t - 26.56^{o})$ Amp

Choice (A)

**15.** $Q = \dfrac{X_L}{R}$

$$q_1 = \frac{\omega L_1}{R_1};\quad q_2 = \frac{\omega L_2}{R_2}$$

If two are connected in series

$\therefore$ overall $Q = \dfrac{\omega(L_1 + L_2)}{R_1 + R_2}$

$$Q = \frac{q_1 R_1 + q_2 R_2}{R_1 + R_2}$$

$$Q = \frac{10\times5+15\times20}{25}$$

$Q = 14$ Choice (A)

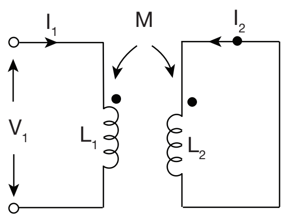
**16.** $\dfrac{V_o(s) - V_{in}(s)}{2S} + \dfrac{V_o(s)}{\frac{2}{S}} = 0$

$V_o(S) - V_{in}(S) + S^2 V_o(S) = 0$
$V_o(S)[1 + S^2] = V_{in}(S)$

$$\frac{V_o(S)}{V_{in}(S)} = \frac{1}{1+S^2} = H(s)$$

$h(t) = \sin t$ Choice (B)

**17.**




Secondary voltage $V_2 = 0$

$$V_1 = L_1 \frac{di_1}{dt} + M.\frac{di_2}{dt}$$

$$0 = L_2 \frac{di_2}{dt} + M\frac{di_1}{dt}$$

Sub $\dfrac{d}{dt} = j\omega$

$V_1 = j\,\omega L_1 I_1 + Mj\,\omega I_2$
$j\,\omega I_2 L_2 = -Mj\,\omega I_1$

$$I_2 = \frac{-MI_1}{L_2}$$

$$V_1 = j\,\omega L_1 I_1 - j\omega\frac{M^2 I_1}{L_2}$$

$$V_1 = j\omega\left(L_1 - \frac{M^2}{L_2}\right)I_1$$

$$\therefore L_{eq} = L_1 - \frac{M^2}{L_2} = 37.5 \text{ mH}$$

$$\omega_o = \frac{1}{\sqrt{LC}} \text{ rad/sec}$$

$$= \frac{1}{\sqrt{37.5\times10^{-3}\times3\times10^{-6}}}$$

$$= \frac{10^4}{\sqrt{3.75\times3}} = 2.98\times10^3 \text{ rad/sec}$$

$f_o = 474.5$ Hz Choice (B)

**18.** $i(t) + (2 + j1) = (5 + j5)$

$\therefore$ $i = (3 + j4)$ Amp
$I = 5\angle\tan^{-1}(4/3)$
$= 5\angle 53.13^\circ$ Amp S
$i(t) = 5\cos(2\pi\times50\,t + 53.13^\circ)$A
$i(t) = 5.\cos(100\,\pi t + 53.13^\circ)$ Amp Choice (B)

**19.** $V_C(\infty) = \underset{S\to0}{lt}\, S.V_C(S)$

$$I_C = c.\frac{dV_c}{dt}$$

$I_C(s) = SC.V_C$

$$V_C(s) = \frac{1}{SC}.I(S).$$

$$V_C(\infty) = Lt\left(\frac{2S+3}{S+2}\right)\times\frac{10^3}{150}$$

$S\to\ 0 = 10$V Choice (B)

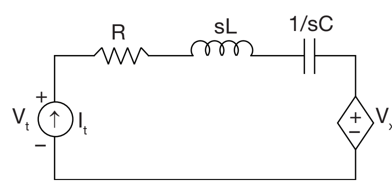
**20.** $Z(s) = \left(\dfrac{2}{s}\right)\|\left[1+(2+s)\|2\right]$

$$= \frac{2}{s}\|\left[1+\frac{4+2s}{4+s}\right] = \left(\frac{2}{s}\right)\|\left[\frac{8+3s}{4+s}\right]$$

$$= \frac{\left(\frac{2}{s}\right)\left(\frac{8+3s}{4+s}\right)}{\frac{2}{s}+\frac{8+3s}{4+s}} = \frac{2(8+3s)}{8+2s+8s+3s^2}$$

$$Z(s) = \frac{2(8+3s)}{3s^2+10s+8}$$ Choice (C)

**21.**




$$V_t - V_x = RI_t + SLI_t + \frac{I_t}{sC}$$

But $V_x = 0.5V_1 \times 1/sc$
$V_1 = 5\,I_t$

$$V_x = \frac{2.5I_t}{sC}$$

$$V_t = I_t\left[5+sL+\frac{1}{sc}+\frac{2.5}{sc}\right];\ \frac{V_t}{I_t} = Z(s)$$

$$Z(s) = 5 + j\omega\,1\times10^{-3} - \frac{j3.5}{\omega\times5\times10^{-9}}$$

at resonance image $Z(s) = 0$

$\therefore \omega^2 = \dfrac{3.5}{5\times10^{-9}\times10^{-3}}$

$\omega^2 = \dfrac{3.5}{5}\times10^{12}$

ω = 836.66 × $10^3$ rad/sec

$f_o$ = 133.158 kHz Choice (D)

**22.** At resonance $I_L + I_C = 0$

∴ $I_L = QI\angle{-90^o}$ A

$I_C = Q.I\angle 90^o$ A

$Q = R\sqrt{\dfrac{C}{L}}$

$Q = 10 \times \sqrt{\dfrac{1}{8}} = 3.53$

∴ $I_L = 25\sqrt{2}\angle{-90^o}$ A

$I_C = 25\sqrt{2}\angle 90^o$ A Choice (A)

**23.** $Z(S) = 2+\left[\dfrac{1}{SC}\,||\left\{1\,||\left(R+\dfrac{1}{S}\right)\right\}\right]$

∴ By comparison we can get

$R = 1\ \Omega$ and $C = 1$ F Choice (A)

**24.** $V_1 = AV_2 + BI_2$

$I_1 = CV_2 + D\,I_2$

When $V_1 = 4$V and $P = 4$ W

∴ $P = I_2^2\,R_L$

$I_2 = \sqrt{\dfrac{P}{R_L}}$ and $P = \dfrac{V_2^2}{R_L}$

$V_2 = \sqrt{P.R_L}$ as $R_L = 2$

$4 = A\sqrt{P.R} + B.\sqrt{\dfrac{P}{R}}$

$4 = A\sqrt{4} + B\sqrt{4}$

2A + 2B = 4

$A + B = 2$ → (i)

$8 = A\sqrt{16} + B\sqrt{16}$

8 = 4A + 4B

∴ $A + B = 2$

$V_1 = 10$

10 = 5A + 5B

∴ $V_2 = 5$ and $I_2 = 5$

$P = I_2^2.R_L = 25\times1 = 25$ W Choice (A)

**25.** If $S\to\infty \Rightarrow C$ = short circuit

$S\to 0 \Rightarrow C \to$ open circuit

∴ for $S\to 0$

$Z(s) = R_1 \,||\, (R_2 + 10)$

For $S\to\infty$

$Z(s) = R_1||10 = 5\ \Omega$

$R_1 = 10\ \Omega$

$10||\,(R_2 + 10) = 6$

$\dfrac{10\times(R_2+10)}{R_2+20} = 6$

$10R_2 + 100 = 6R_2 + 140$

$4R_2 = 20$

$R_2 = 5\ \Omega$ Choice (B)