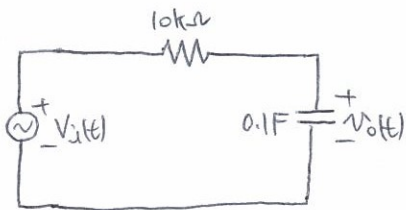


[9] 다음 회로에 대하여 답하시오.

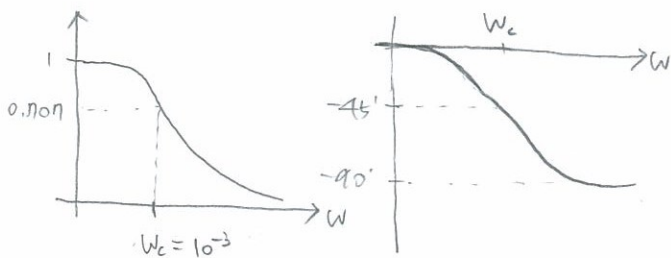


① 전달함수  $H(s) = \frac{V_o(s)}{V_i(s)}$  를 구하시오.

$$V_o(s) = \frac{\frac{1}{0.1s}}{10k + \frac{1}{0.1s}} V_i(s) = \frac{1}{10^3s + 1} V_i(s)$$

$$\therefore H(s) = \frac{1}{10^3s + 1}$$

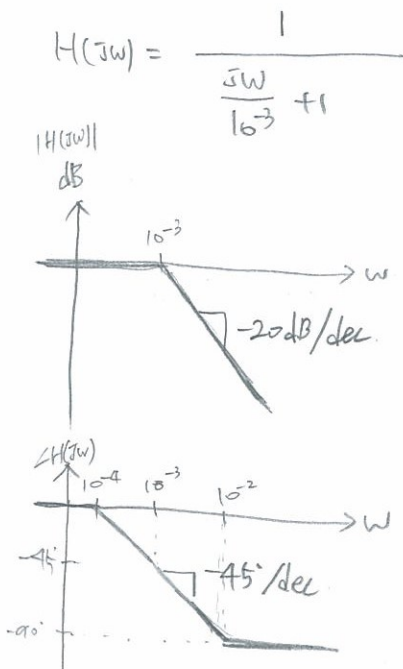
② 진폭특성곡선과 위상특성곡선을 그리시오.



③ 이 회로의 주파수 특성은?

$$H(0) = 1, H(\infty) = 0 \Rightarrow \text{저역통과필터}$$

④ Bode plot을 그리시오.

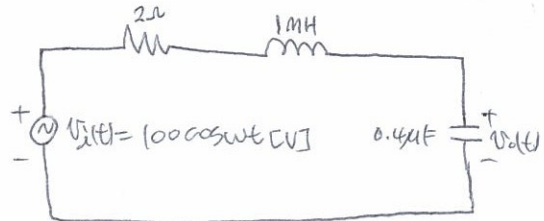


⑤ 차단주파수  $W_c$ 와 대역폭 BW를 구하시오.

$$W_c = \frac{1}{RC} = 10^{-3}$$

$$BW = W_c = 10^{-3}$$

[10]



① 전달함수  $H(s)$ 를 구하시오.

$$\begin{aligned} H(s) &= \frac{\frac{2.5 \times 10^6}{s}}{2 + 10^{-3}s + \frac{2.5 \times 10^6}{s}} \\ &= \frac{2.5 \times 10^6}{10^{-3}s^2 + 2s + 2.5 \times 10^6} \\ &= \frac{2.5 \times 10^9}{s^2 + 2 \times 10^3s + 2.5 \times 10^9} \end{aligned}$$

$$\therefore H(s) = \frac{10^{10}}{4s^2 + 8 \times 10^3s + 10^{10}}$$

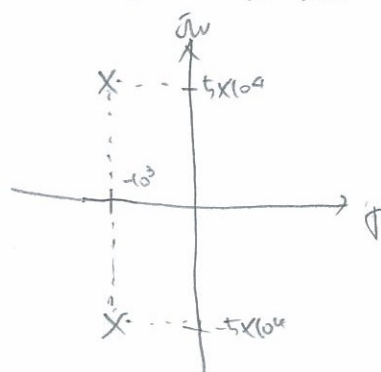
② 극점과 영점의 분포를 그리시오.

$$\text{영점} \Rightarrow \text{존재 X} \quad (2.5 \times 10^3)/10^6$$

$$\text{극점} \Rightarrow s^2 + 2 \times 10^3s + 2.5 \times 10^9 = 0$$

$$(s + 10^3)^2 + 2.5 \times 10^9 - 10^6 = 0$$

$$s = -10^3 \pm 15 \times 10^4 j$$



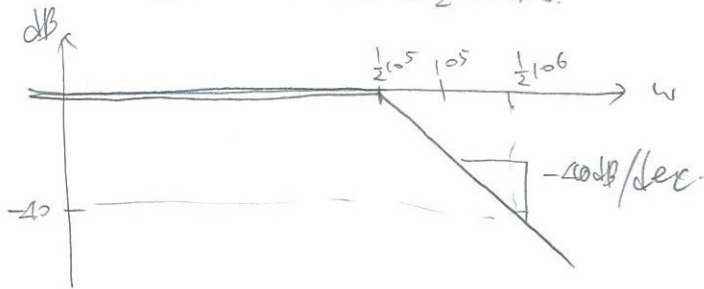
③ 진폭특성을 나타내는 Bode plot을 그리시오.

$$H(s) = \frac{1}{(4 \times 10^{10})s^2 + (8 \times 10^4)s + 1}$$

$$= \frac{1}{(1 + \frac{s}{\frac{1}{2 \times 10^5}})^2}$$

$$|H(j\omega)| = -20 \log \left| 1 + \frac{j\omega}{\frac{1}{2 \times 10^5}} \right|^2 = -40 \log \left| 1 + \frac{j\omega}{\frac{1}{2 \times 10^5}} \right|$$

$\omega \gg \frac{1}{2 \times 10^5} \Rightarrow -40, \omega \ll \frac{1}{2 \times 10^5} \Rightarrow 0.$



④ 어떤 종류의 필터인가?

$$H(0) = 1, H(\infty) = 0 \Rightarrow \text{저역통과필터.}$$

⑤ 공진주파수와 대역폭 BW를 구하시오.

$$\omega_0 = \frac{1}{\sqrt{LC}} = 5 \times 10^4$$

$$BW = \frac{R}{L} = 2 \times 10^3$$

⑥ 반전력주파수는?

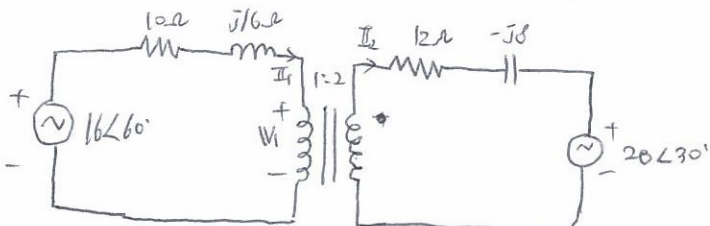
$$\omega_1 = \omega_0 - \frac{1}{2}BW = 49000$$

$$\omega_2 = \omega_0 + \frac{1}{2}BW = 51000$$

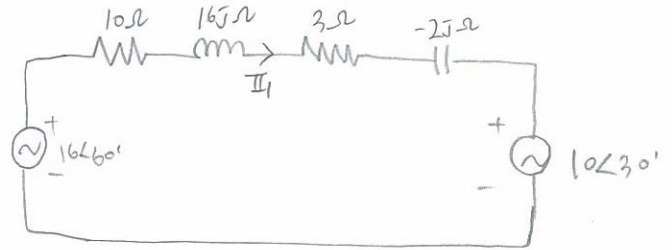
⑦ Quality factor Q를 구하시오.

$$Q = \frac{\omega_0}{BW} = 25$$

[11] 다음의 이상연립기 회로에 대하여 답하시오.



① 1차측으로 환산한 등가회로를 그리시오.



②  $I_1$ 을 구하시오.

$$I_1 = \frac{16 \angle 60^\circ - 20 \angle 30^\circ}{3 + j4} = 0.316 + j0.34j$$

$$= 0.465 \angle 47.14^\circ$$

③  $I_2$ 을 구하시오.

$$I_2 = \frac{1}{2}I_1 = 0.2325 \angle 47.14^\circ$$

④  $V_1$ 을 구하시오.

$$V_1 = I_1(3 - j4) + 10 \angle 30^\circ = 10.3 + j5.39j$$

$$= 11.62 \angle 27.64^\circ$$

⑤  $V_2$ 을 구하시오.

$$V_2 = 2V_1 = 23.23 \angle 27.64^\circ$$

[12]  $H(s) = \frac{10^3 s (s + 10^3)}{(s + 10)(s + 10^4)}$  의 Bode plot을 그리시오. ①, ②

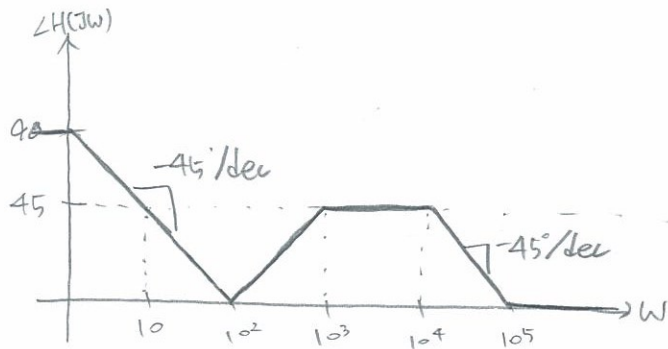
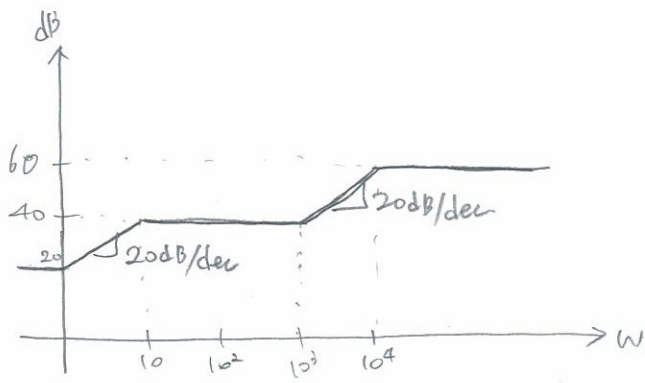
$$H(s) = \frac{10^3 \cdot 10^3 \left( \frac{s}{10^3} + 1 \right) s}{10 \cdot 10^4 \left( \frac{s}{10} + 1 \right) \left( \frac{s}{10^4} + 1 \right)}$$

$$= \frac{10 \left( 1 + \frac{s}{10^3} \right) s}{\left( 1 + \frac{s}{10} \right) \left( 1 + \frac{s}{10^4} \right)}$$

$$|H(j\omega)|_{dB} = 20 + 20 \log \omega + 20 \log \left( 1 + \frac{\omega}{10^3} \right)$$

$$- 20 \log \left( 1 + \frac{\omega}{10} \right) - 20 \log \left( 1 + \frac{\omega}{10^4} \right)$$

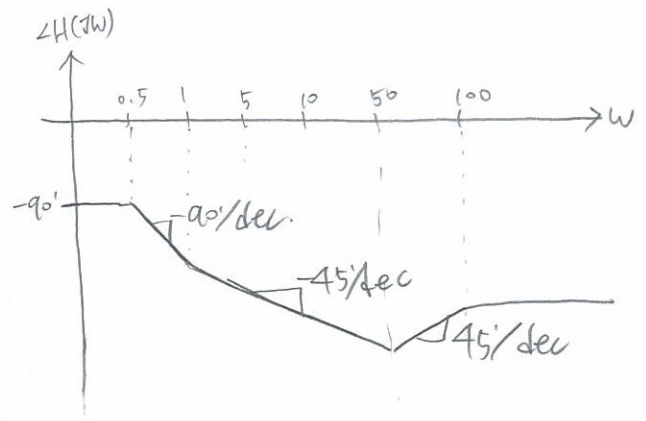
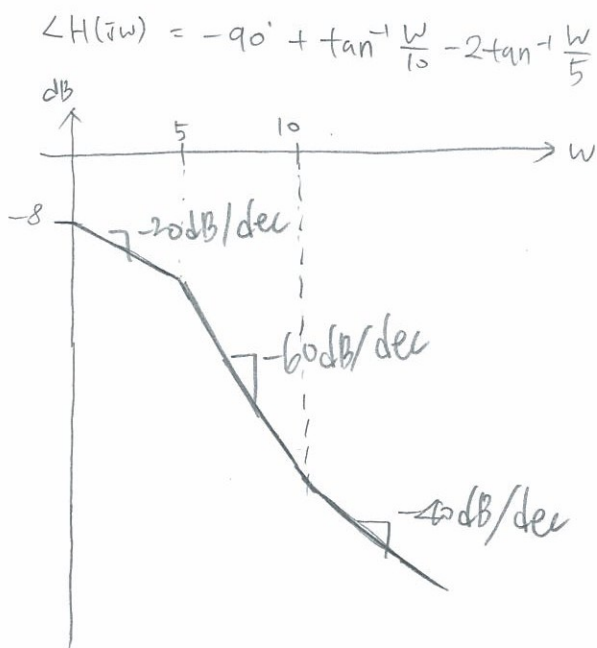
$$\angle H(j\omega) = 90 + \tan^{-1} \frac{\omega}{10^3} - \tan^{-1} \frac{\omega}{10} - \tan^{-1} \frac{\omega}{10^4}$$



[13]  $H(s) = \frac{s+10}{s(s+5)^2}$  의 Bode plot 을 그려라. ①. ②

$$H(s) = \frac{10(\frac{s}{10} + 1)}{25s(\frac{s}{5} + 1)^2}$$

$$|H(j\omega)|_{dB} = \underbrace{20 \log \frac{2}{5}}_{-8} + 20 \log(1 + \frac{\omega}{10}) - 20 \log \omega - 40 \log(1 + \frac{\omega}{5})$$



[14] Bode 크기 선도가 다음과 같을 때, 전달 함수  $H(s)$  를 구하시라.

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

$$\therefore H(s) = \frac{10^{10}(s+10)}{(s+10^2)(s+10^4)^2}$$

[15] Bode 크기 선도와 다음과 같을 때,  $H(s)$  는?

$$H(s) = \frac{10^2 s}{(s+1)(\frac{s}{5} + 1)}$$

$$\therefore H(s) = \frac{500s}{(s+1)(s+5)}$$

[16]  $v(t) = 2 + \sqrt{2} \cos 2t + \cos 4t$  [V] 의 실효전압을 구하시라.

$$V_{dc} = 2, \quad a_n = \sqrt{2}, \quad b_n = 1$$

$$V_{rms}^2 = V_{dc}^2 + \frac{1}{2} \sum_{n=1}^{\infty} (a_n^2 + b_n^2)$$

$$= 4 + \frac{1}{2}(3) = 5.5$$

$$\therefore V_{rms} = \sqrt{5.5} = 2.345 \text{ [V]}$$