

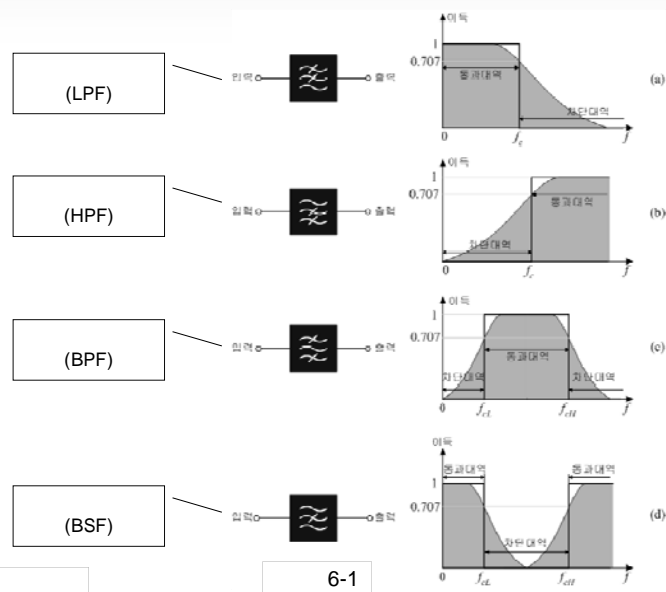
6

(Filters)

(LPF)
(HPF)
(BPF)
(BSF)

- 1 -

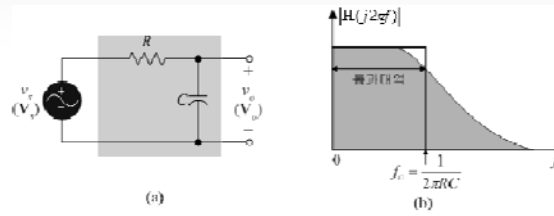
6.1



6-1

- 2 -

6.2



6-2

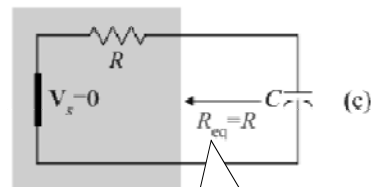
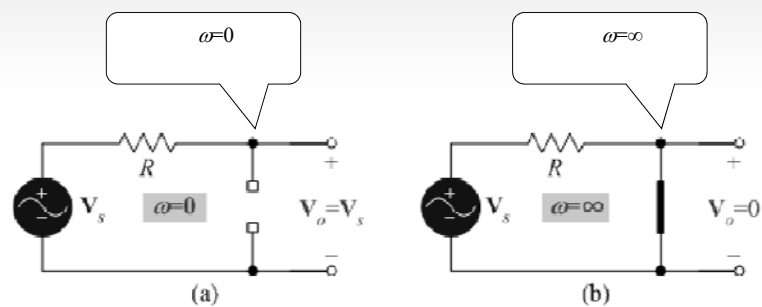
$$H(j\omega) = \frac{V_o}{V_s} = \frac{1/j\omega C}{R + 1/j\omega C} = \frac{1}{1 + j\omega RC}$$

$$|H(j\omega)| = \left| \frac{1}{1 + j\omega RC} \right| = \frac{1}{\sqrt{1 + (\omega RC)^2}}$$

$$|H(j\omega)| = \begin{cases} 1, & \omega = 0 \\ 0, & \omega = \infty \end{cases}$$

$$\omega_c = \frac{1}{RC} \quad \left(f_c = \frac{1}{2\pi RC} \right) \quad \omega_c = \frac{1}{\tau} \quad \left(f_c = \frac{1}{2\pi\tau} \right)$$

- 3 -

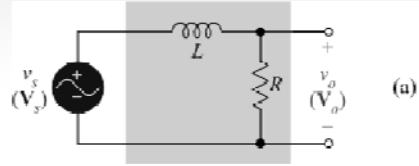


6-3

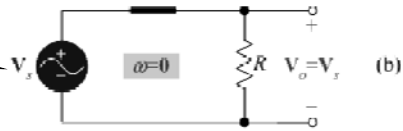
$$\tau = R_{eq}C = RC$$

- 4 -

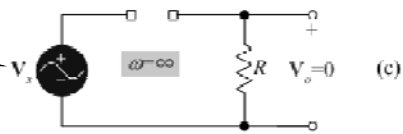
6-6



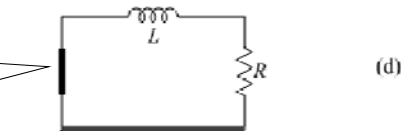
$\omega=0$



$\omega=\infty$

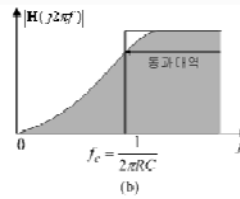
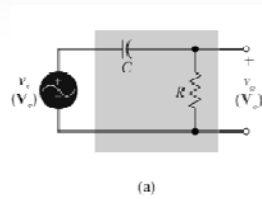


$\tau=L/R$



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6.3



6-7

$$\mathbf{H}(j\omega) = \frac{\mathbf{V}_o}{\mathbf{V}_s} = \frac{R}{R + 1/j\omega C} = \frac{j\omega RC}{1 + j\omega RC}$$

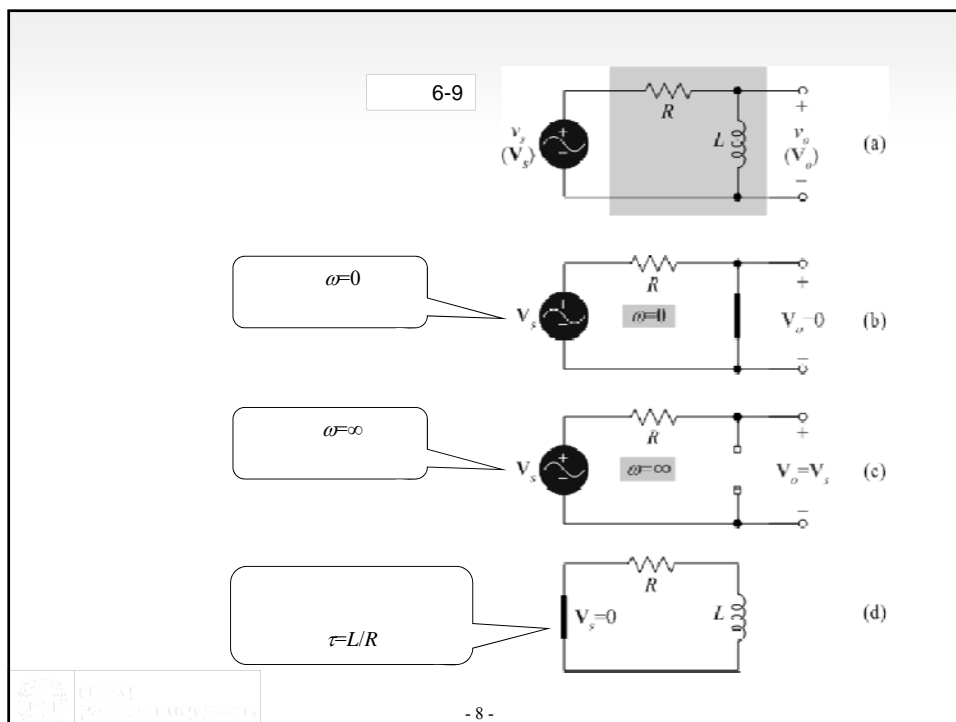
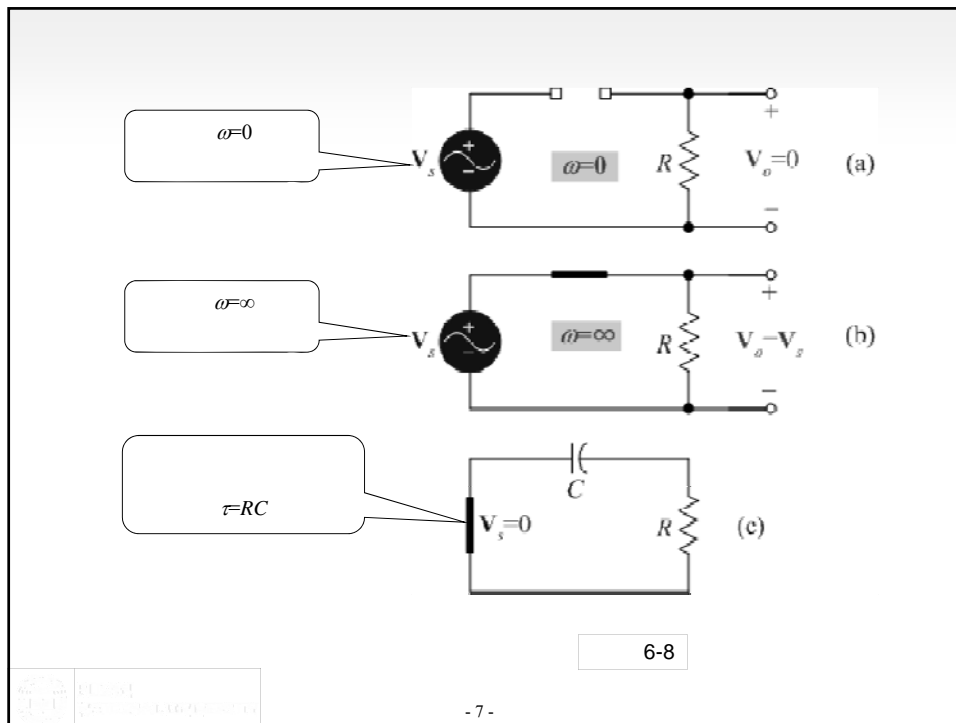
$$|\mathbf{H}(j\omega)| = \left| \frac{j\omega RC}{1 + j\omega RC} \right| = \frac{\omega RC}{\sqrt{1 + (\omega RC)^2}}$$

$$|\mathbf{H}(j\omega)| = \begin{cases} 0, & \omega = 0 \\ 1, & \omega = \infty \end{cases}$$

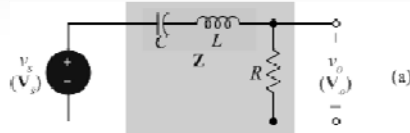
$$\frac{\omega_c RC}{\sqrt{1 + (\omega_c RC)^2}} = \frac{1}{\sqrt{2}}$$

$$\omega_c = \frac{1}{RC} = \frac{1}{\tau} \quad \left(f_c = \frac{1}{2\pi\tau} \right)$$

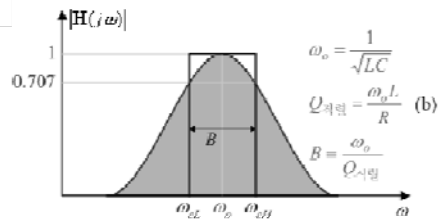
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6.4



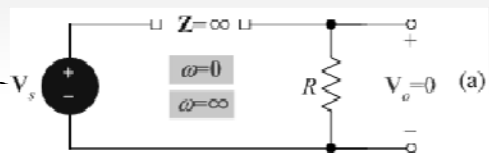
6-10



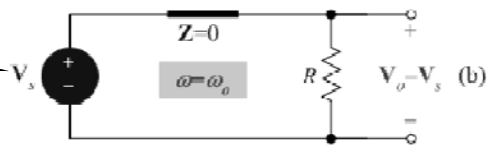
$$Z = j\omega L - j\frac{1}{\omega C} = j\left(\omega L - \frac{1}{\omega C}\right)$$

$$H(j\omega) = \frac{V_o}{V_s} = \frac{R}{Z + R} = \frac{R}{R + j(\omega L - 1/\omega C)}$$

$\omega=0, \omega=\infty$
LC

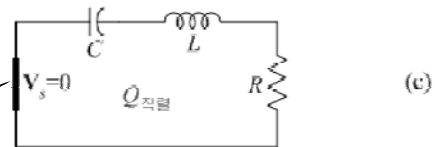


$\omega=\omega_o$
LC



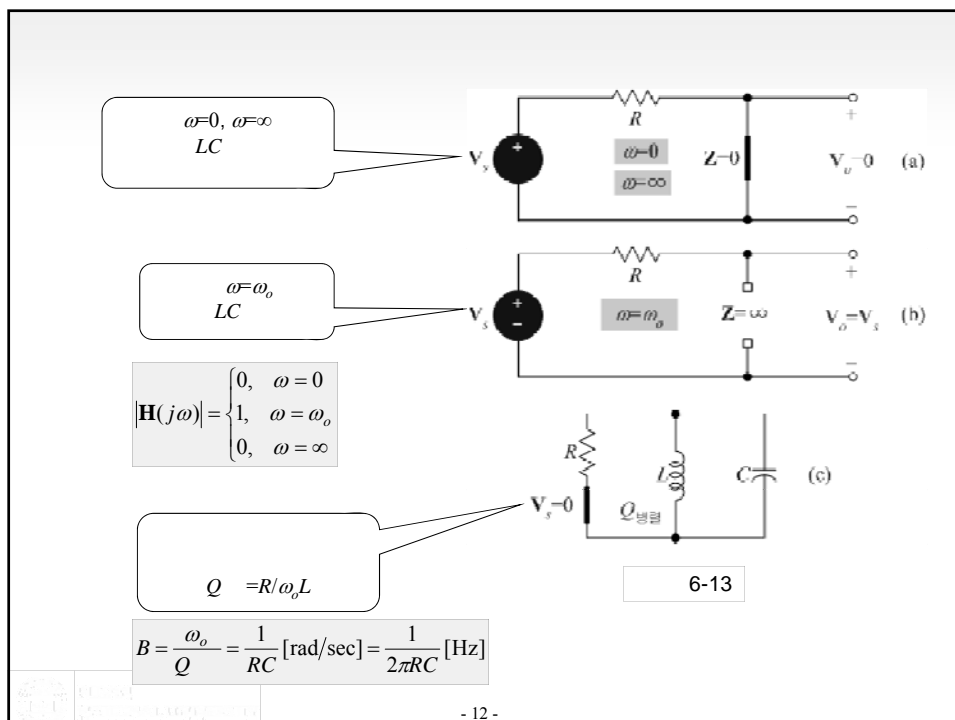
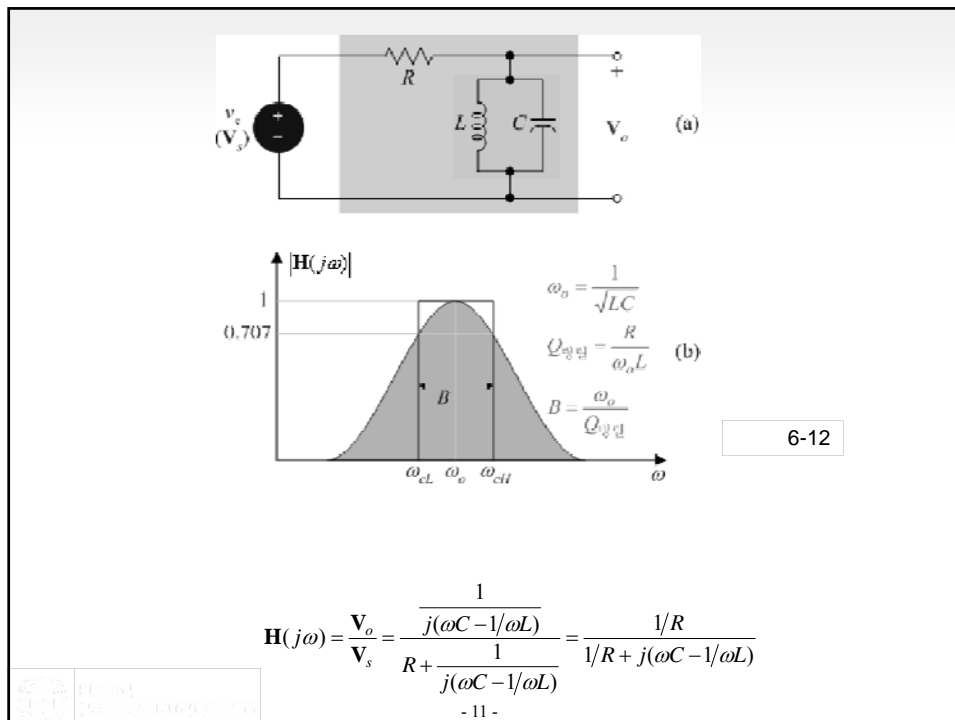
$$|H(j\omega)| = \begin{cases} 0, & \omega = 0 \\ 1, & \omega = \omega_o \\ 0, & \omega = \infty \end{cases}$$

$Q = \omega_o L/R$



6-11

$$B = \frac{\omega_o}{Q} = \frac{R}{L} [\text{rad/sec}] = \frac{R}{2\pi L} [\text{Hz}]$$

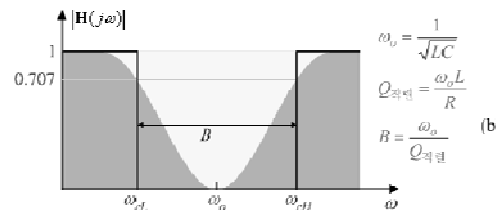
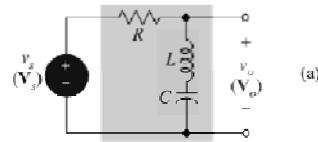


6.5

$$\mathbf{H}(j\omega) = \frac{\mathbf{Z}}{R + \mathbf{Z}} = \frac{j(\omega L - 1/\omega C)}{R + j(\omega L - 1/\omega C)}$$

$$|\mathbf{H}(j\omega)| = \frac{\omega L - 1/\omega C}{\sqrt{R^2 + (\omega L - 1/\omega C)^2}}$$

$$B = \frac{R}{L} [\text{rad/sec}] = \frac{R}{2\pi L} [\text{Hz}]$$

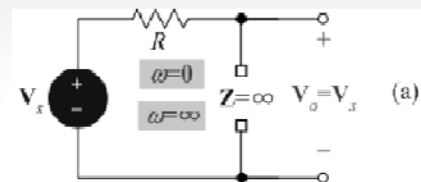


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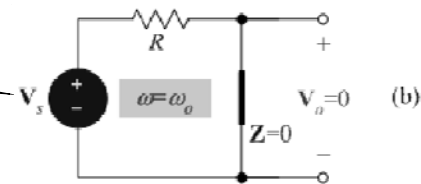
$$\omega = 0, \omega = \infty$$

$$LC$$



$$\omega = \omega_o$$

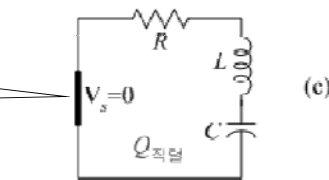
$$LC$$



$$|\mathbf{H}(j\omega)| = \begin{cases} 1, & \omega = 0 \\ 0, & \omega = \omega_o \\ 1, & \omega = \infty \end{cases}$$

$$Q_{\text{wtr}} = \omega_o L / R$$

$$B = \frac{\omega_o}{Q} = \frac{R}{L} [\text{rad/sec}] = \frac{R}{2\pi L} [\text{Hz}]$$



6-16

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6-19

$\omega=0, \omega=\infty$
 LC

$\omega=\omega_o$
 LC

$$|H(j\omega)| = \begin{cases} 1, & \omega = 0 \\ 0, & \omega = \omega_o \\ 1, & \omega = \infty \end{cases}$$

$$Q = R/\omega_o L$$

$$B = \frac{\omega_o}{Q} = \frac{1}{RC} [\text{rad/sec}] = \frac{1}{2\pi RC} [\text{Hz}]$$

