(3) $V_{in} = V_R(t) + V_L(t) + V_{out}(t) = R\,i(t) + L\frac{d}{dt}i(t) + V_{out} =$

(A) $= RC\frac{d}{dt}V_{out}(t) + LC\frac{d}{dt}\frac{d}{dt}V_{out}(t) + V_{out}$

$$V_{in} = LC\frac{d^2}{dt^2}V_{out}(t) + RC\frac{d}{dt}V_{out}(t) + V_{out}$$

(B) $V_{in}(\omega) = (j\omega)^2 LC\,V_{out}(\omega) + j\omega RC\,V_{out}(\omega) + V_{out}(\omega) = (1 + j\omega RC + j^2\omega^2 LC)\,V_{out}(\omega)$

$$H(\omega) = \frac{V_{out}(\omega)}{V_{in}(\omega)} = \frac{1}{1 + j\omega RC + j^2\omega^2 LC} = \frac{1}{(1-\omega^2 LC) + j\omega RC}$$

$\omega \to 0 \quad |H(\omega)| \to 1$

$\omega \to \infty \quad |H(\omega)| \to 0$

Low Pass.

$$|H(\omega)| = \frac{1}{\sqrt{(1-\omega^2 LC)^2 + (j\omega RC)^2}} = \frac{1}{\sqrt{1 + \omega^2R^2C^2 + C^2L^2\omega^4 - 2CL\omega^2}}$$

(D) $$\frac{d}{d\omega}|H(\omega)| = -\frac{C\omega(2CL^2\omega^2 + CR^2 - 2L)}{(C^2\omega^2(L^2\omega^2+R^2) - 2CL\omega^2 + 1)^{3/2}} = 0 \rightarrow$$

$\rightarrow \underset{\omega=0}{C\omega}(2CL^2\omega^2 + CR^2 - 2L) = 0 \rightarrow 2CL^2\omega^2 + CR^2 - 2L = 0 \rightarrow \omega^2 = \frac{2L - CR^2}{2CL^2} \rightarrow$

$\rightarrow \omega = \sqrt{\frac{2L-CR^2}{2CL^2}}$ or 0