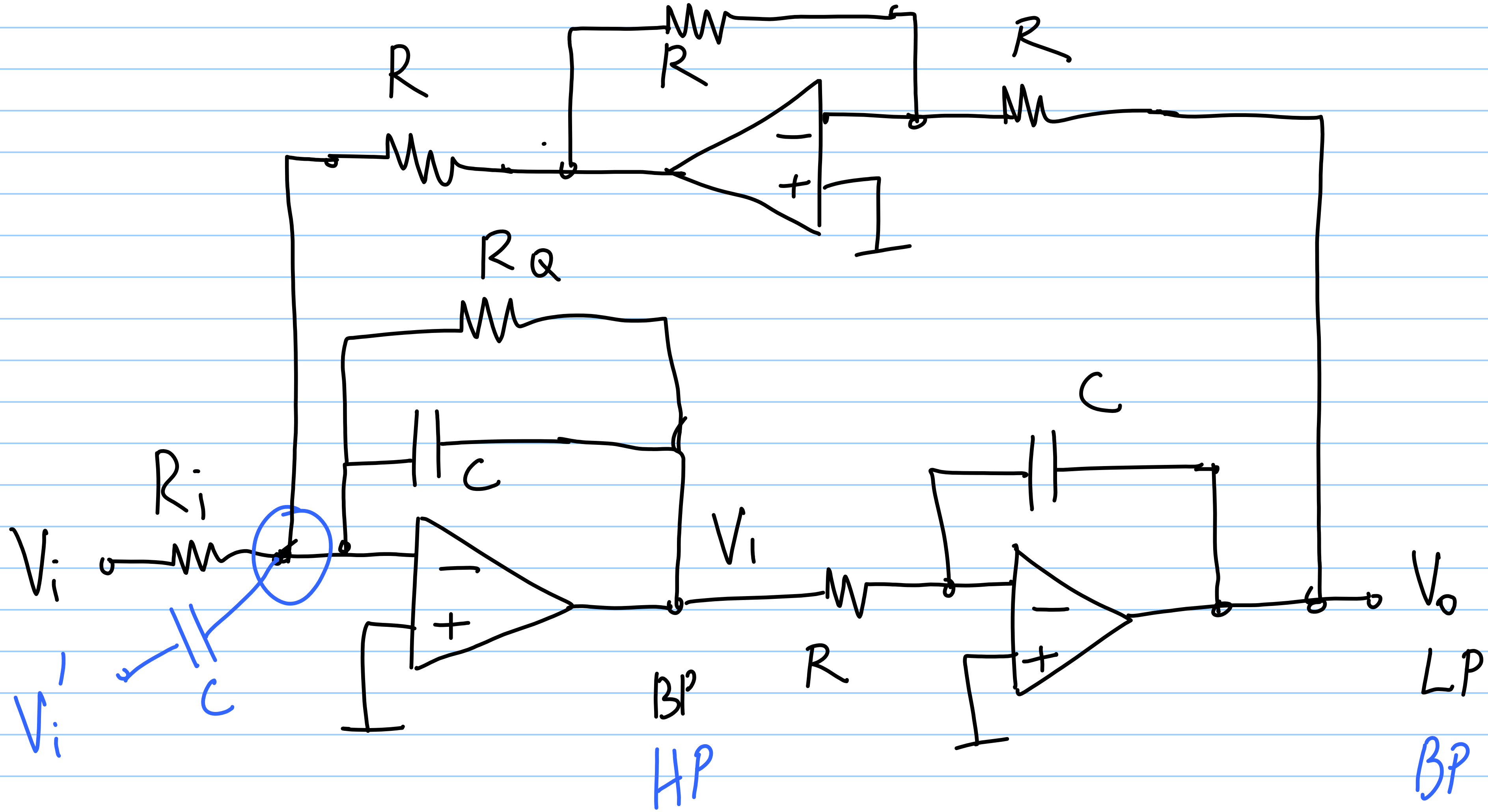
20/03/2019

Lecture 30



$$\frac{V_o(s)}{V_i(s)} = \frac{(R/R_i)}{1 + sCR\underbrace{\left(\frac{R}{R_Q}\right)}_{Q} + s^2C^2R^2}$$

$(R/R_i) \rightarrow$ DC gain

R_i changes DC gain

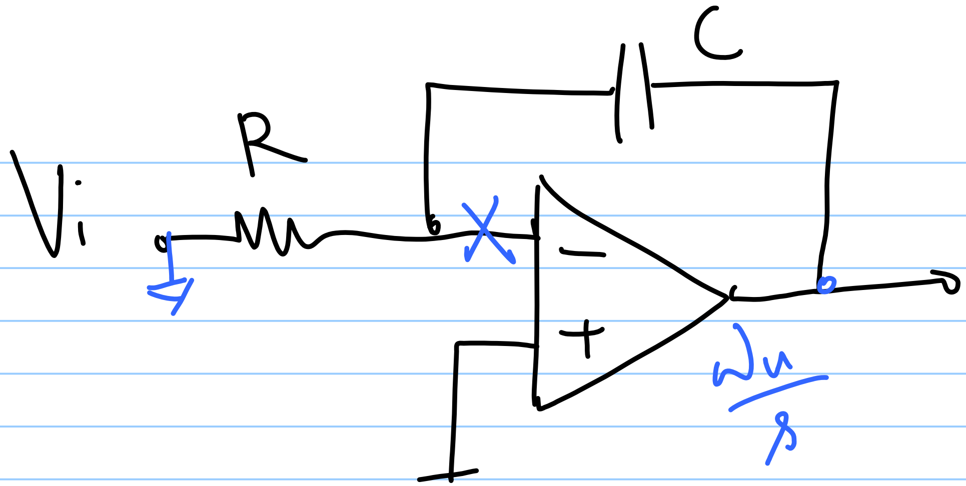
$$1 + \frac{s}{\omega_n \cdot Q} + \frac{s^2}{\omega_n^2}$$

R_Q changes $\frac{R_Q}{R}$ Q

$$s^2 + 2\zeta\omega_n s + \omega_n^2$$

$$\omega_n = \frac{1}{RC}$$

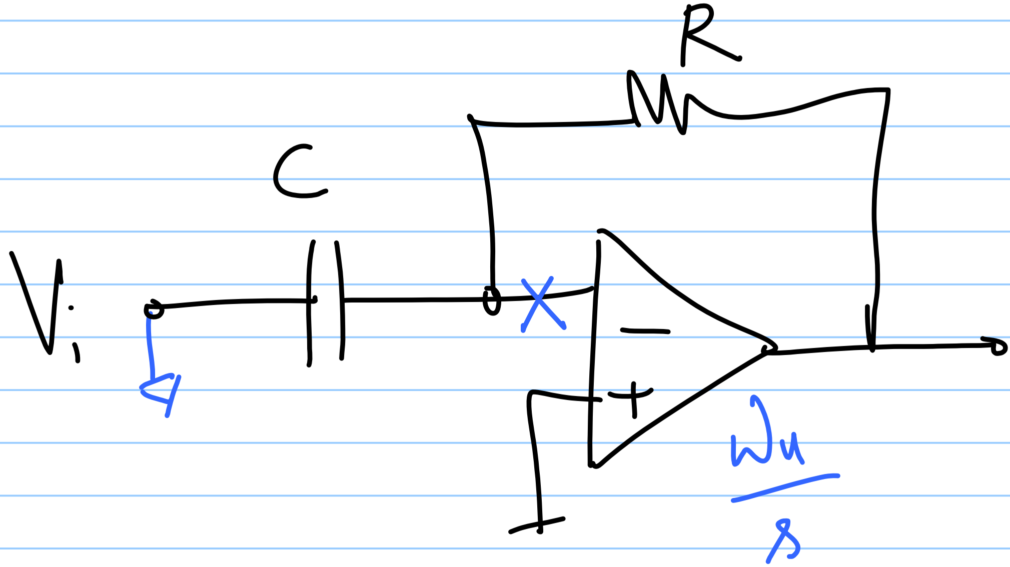
$$2\zeta = \frac{1}{Q}$$



$$V_o = -\frac{V_i}{sCR}$$

Integr- -ator

$$\beta = \frac{sCR}{1+sCR}$$

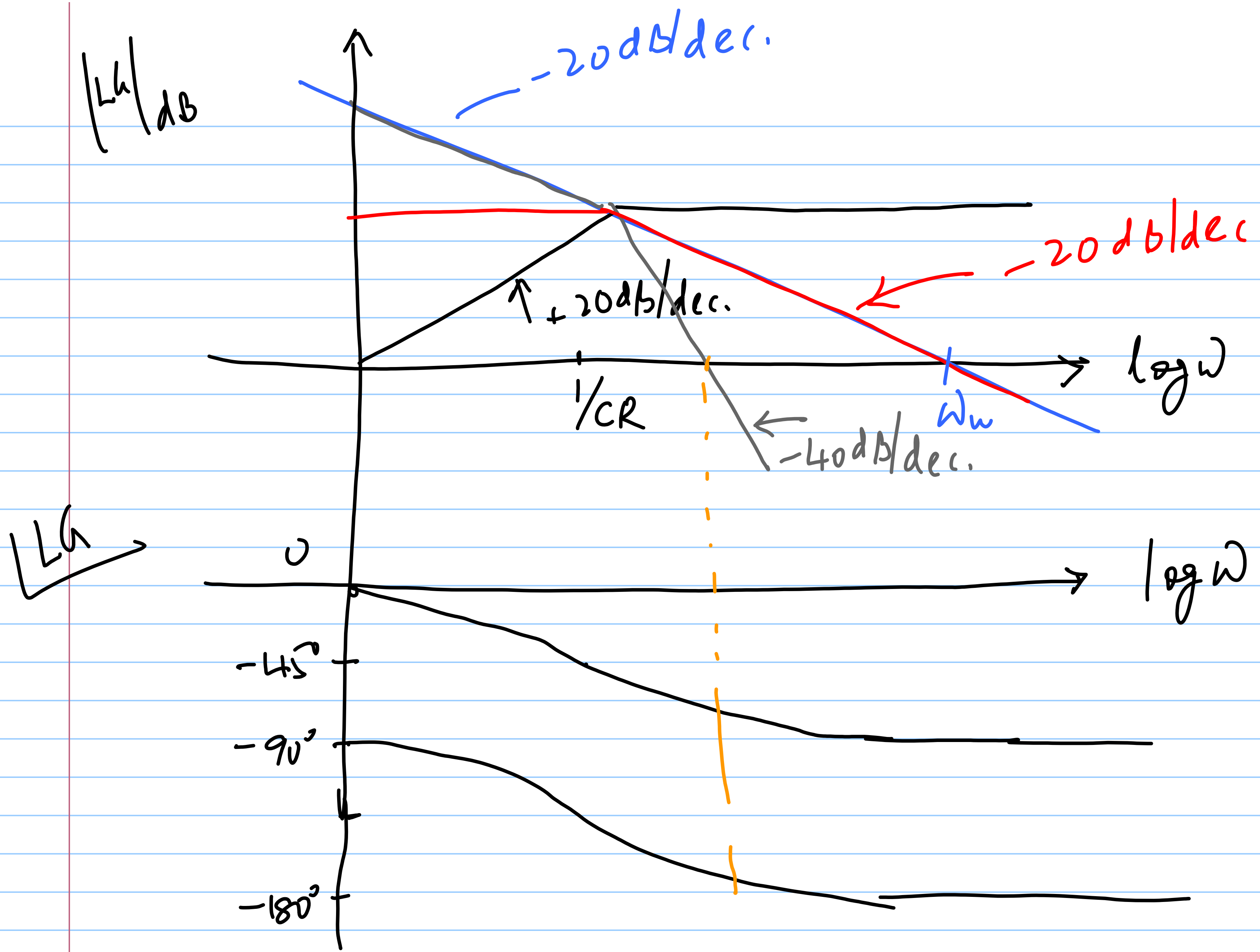


$$V_o = -sCR \cdot V_i$$

Differentiator

$$\beta = \frac{1}{1+sCR}$$

$$\omega_u \gg 1/RC$$



|LG|dB
-20dB/dec.
-20db/dec.
+20dB/dec.
log ω
1/CR
ωu
-40dB/dec.
∠LG
0
log ω
-45°
-90°
-180°

Integrator

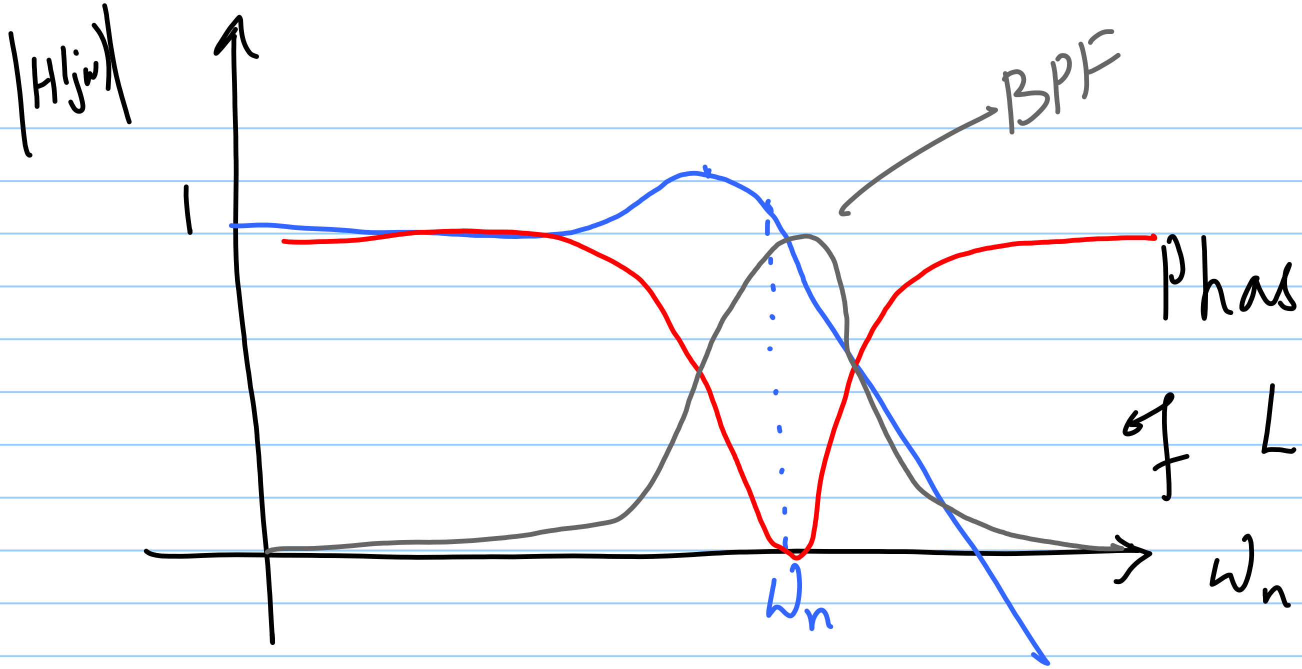
$$LG(s) = -\frac{sCR}{1+sCR} \cdot \frac{\omega_u}{s}$$

$$= -\frac{\omega_u CR}{1+sCR}$$

$$|LG(j\omega)| = \frac{\omega_u CR}{\sqrt{1+\omega^2C^2R^2}}$$

Differentiator

$$LG(s) = -\frac{\omega_u}{s} \cdot \frac{1}{1+sCR}$$



Phase response – HW of LPF, HPF etc.

$$H(s) = \frac{V_o(s)}{V_i(s)} = \frac{1}{1 + sCR + s^2 LCRC_1R_1} \qquad LPF$$

HPF : $$H_2(s) = \frac{s^2/\omega_n^2}{1 + \frac{s}{\omega_n Q} + \frac{s^2}{\omega_n^2}}$$

BPF : $$H_3(s) = \frac{s/\omega_n}{1 + \frac{s}{\omega_n Q} + \frac{s^2}{\omega_n^2}}$$

Notch Filter
or Band stop filter

$$H_4(s) = \frac{(?)}{(?)}$$

HW