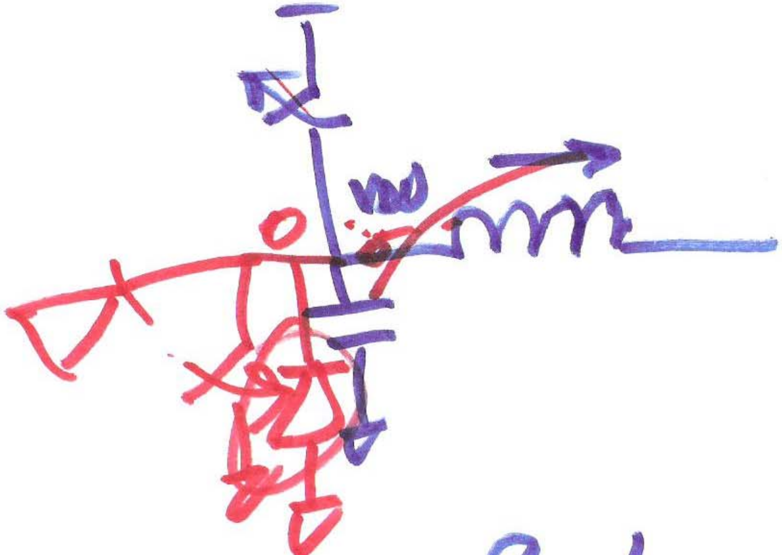
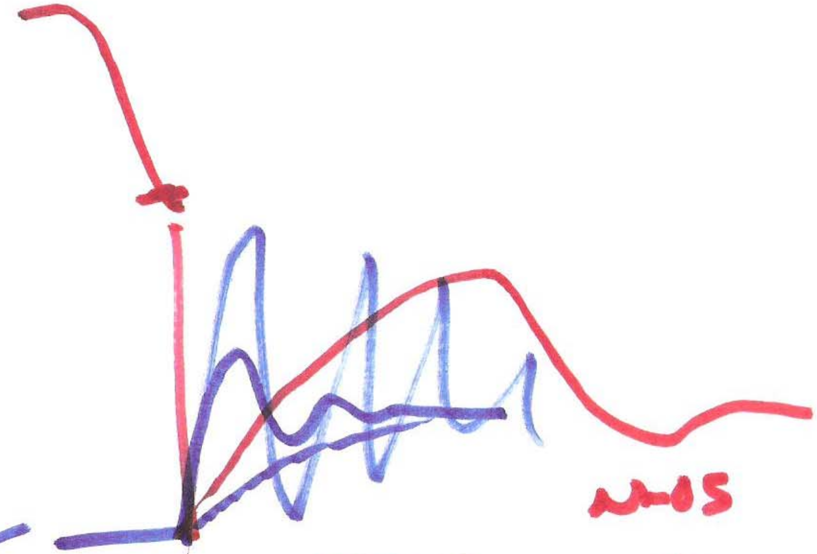
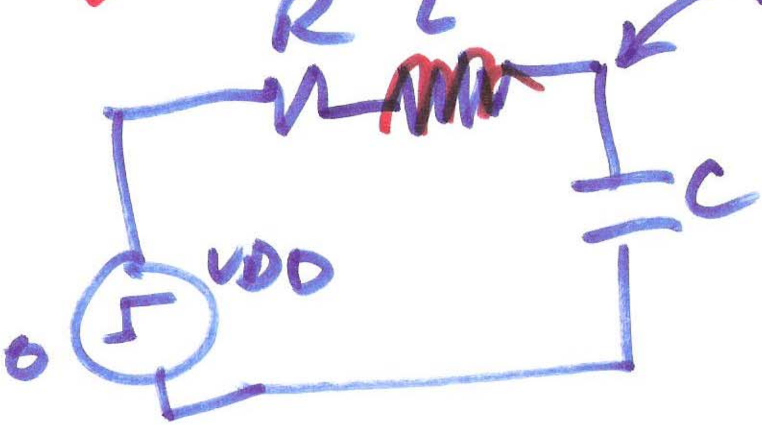
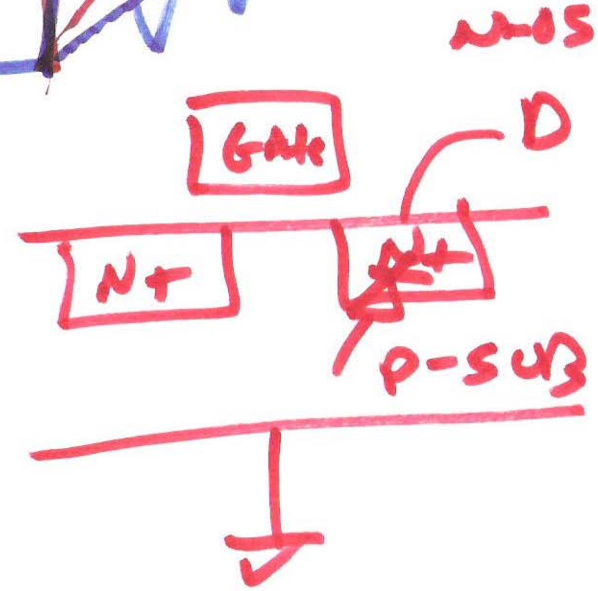
ECE 5/472 Power Electronics

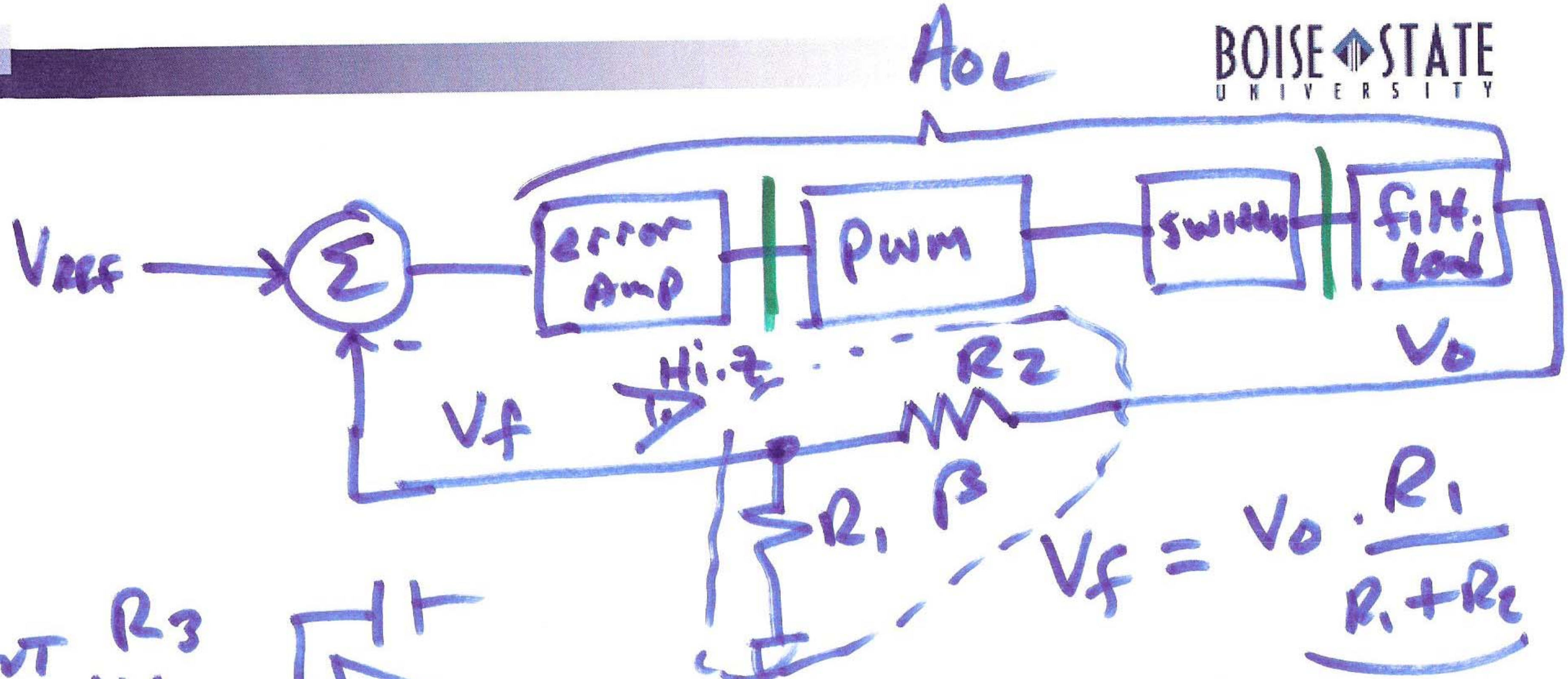
Lecture 14, OCT. 11, 2011







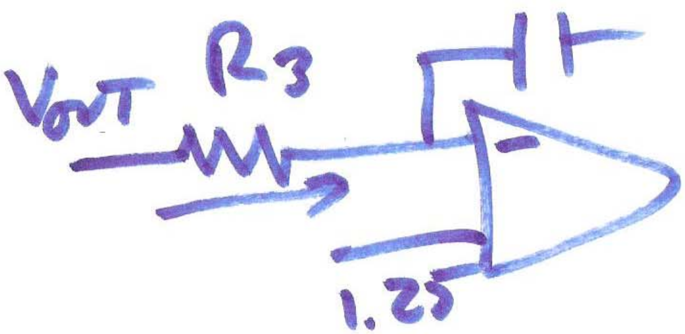




$$V_f = V_o \cdot \frac{R_1}{R_1+R_2}$$

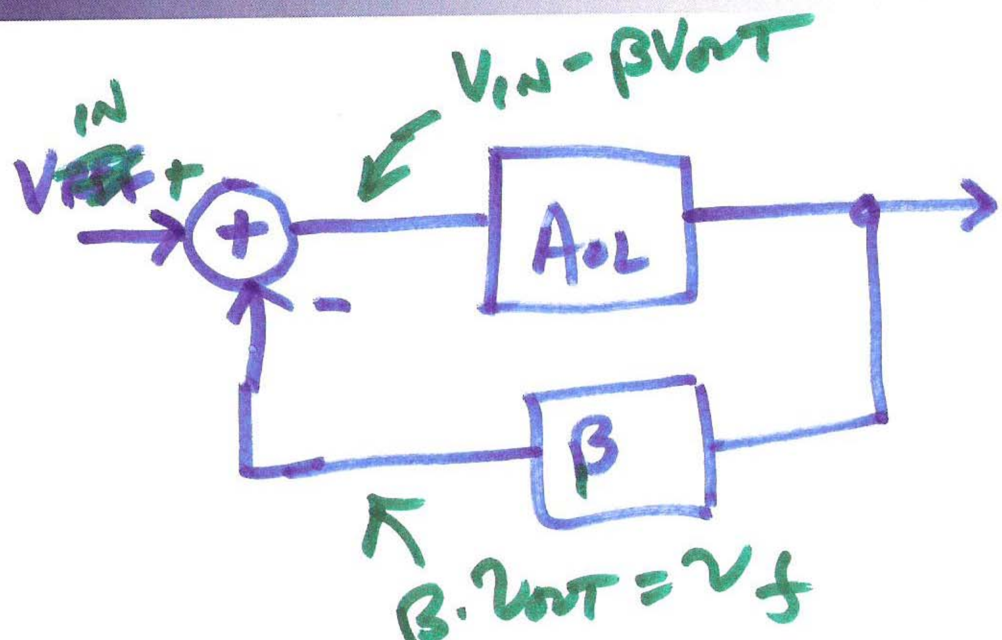
$$\beta$$

$$V_o \cdot \beta = V_f$$



$$\frac{V_{OUT}-1.25}{R_3}$$

2)



$$V_{OUT} = A_{OL} \cdot (V_{IN} - \beta V_{OUT})$$

$$\beta = 1$$
$$|A_{OL}| = 1$$
$$\angle A_{OL} = \mp 180$$

$$V_{OUT}(1 + A_{OL}\beta) = A_{OL} \cdot V_{IN}$$

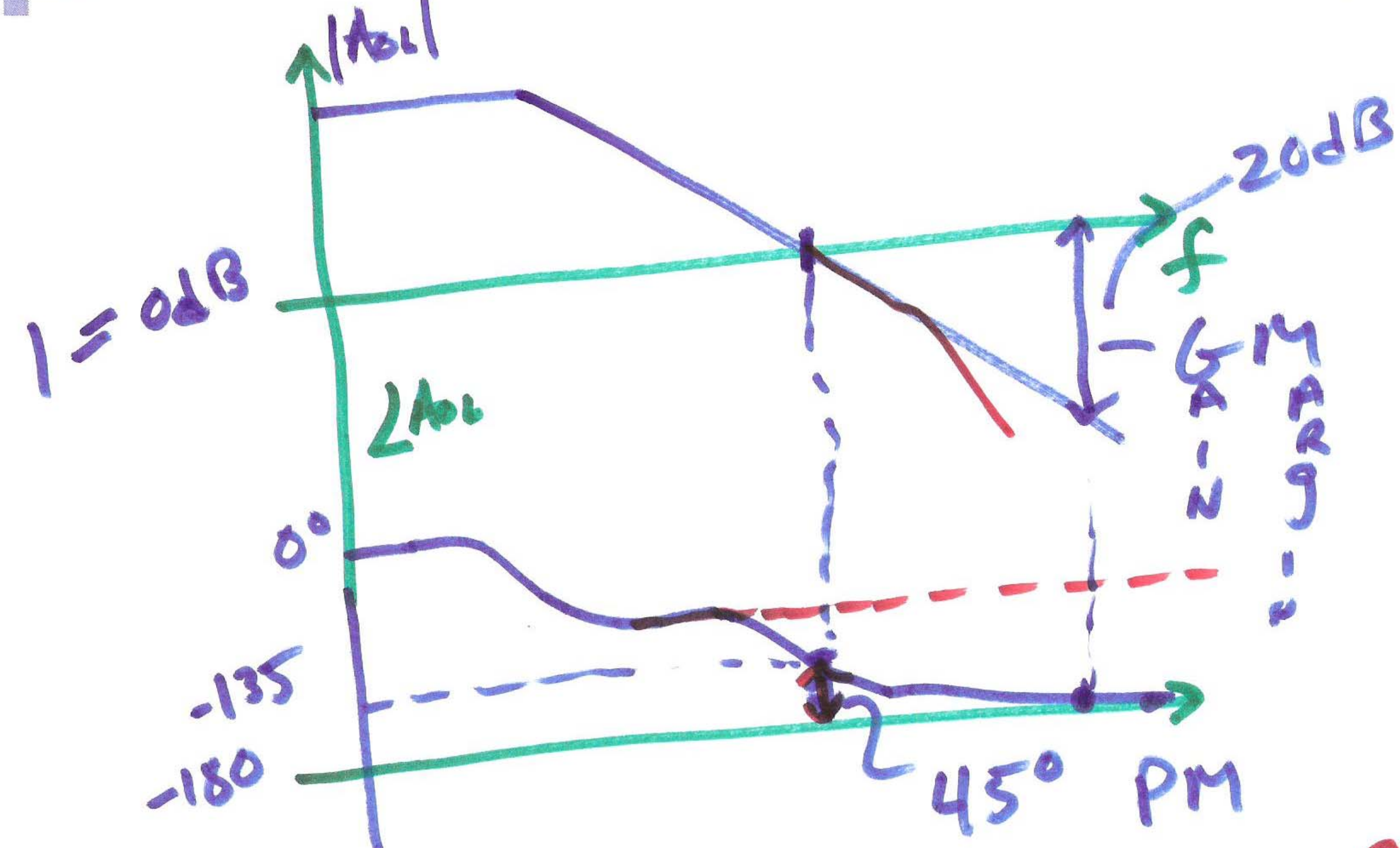
$$\frac{V_{OUT}}{V_{IN}} = \frac{A_{OL}}{1 + A_{OL} \cdot \beta}$$

$A_{OL} \cdot \beta =$ loop gain

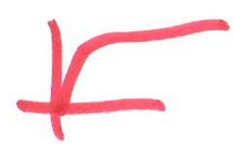
$$A_{OL} \cdot \beta = -1$$

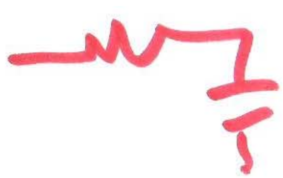
$$|A_{OL} \cdot \beta| = 1 \qquad \angle A_{OL} \cdot \beta = \pm 180°$$

3)



Ideally PM 90°





4)

switch transfer function

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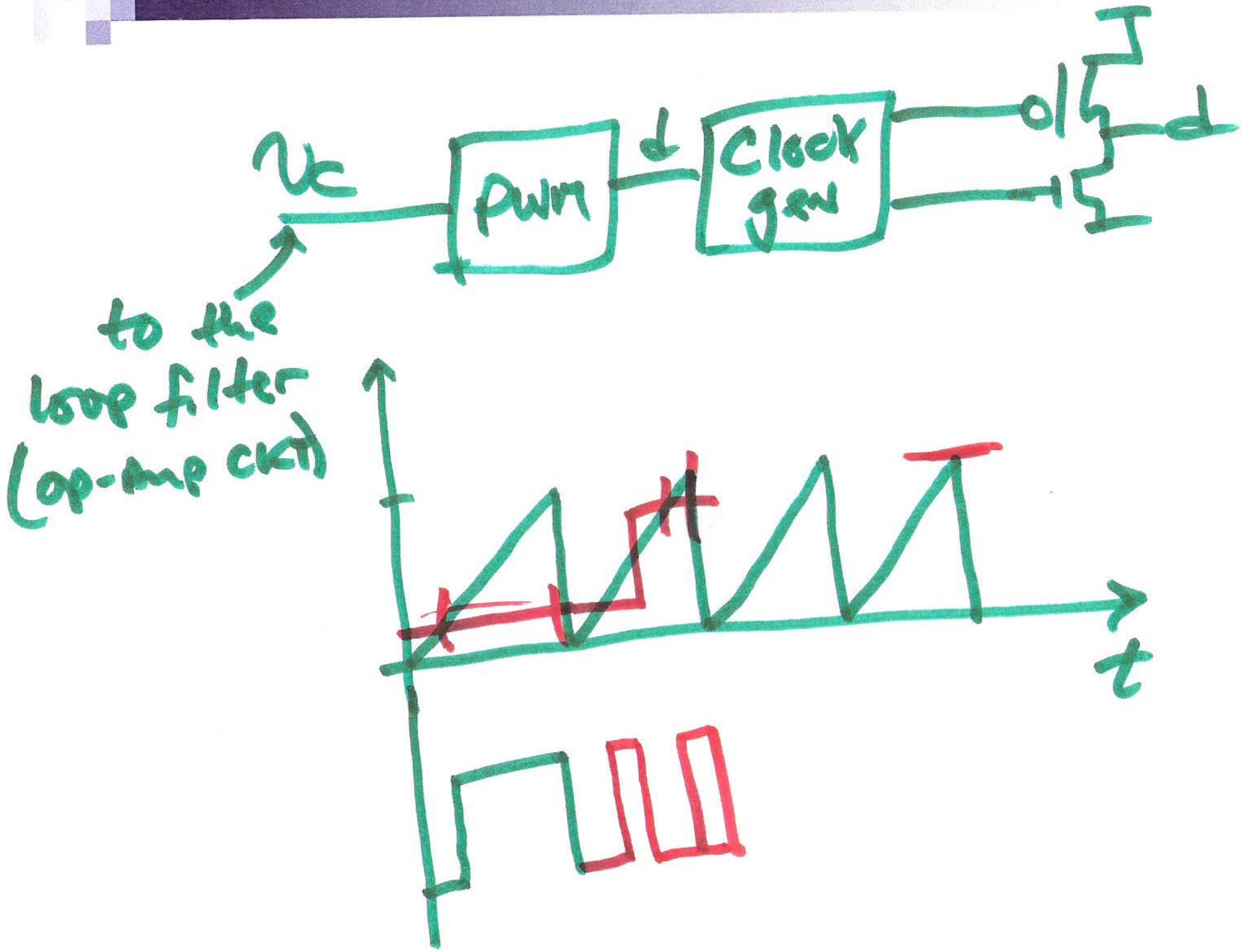
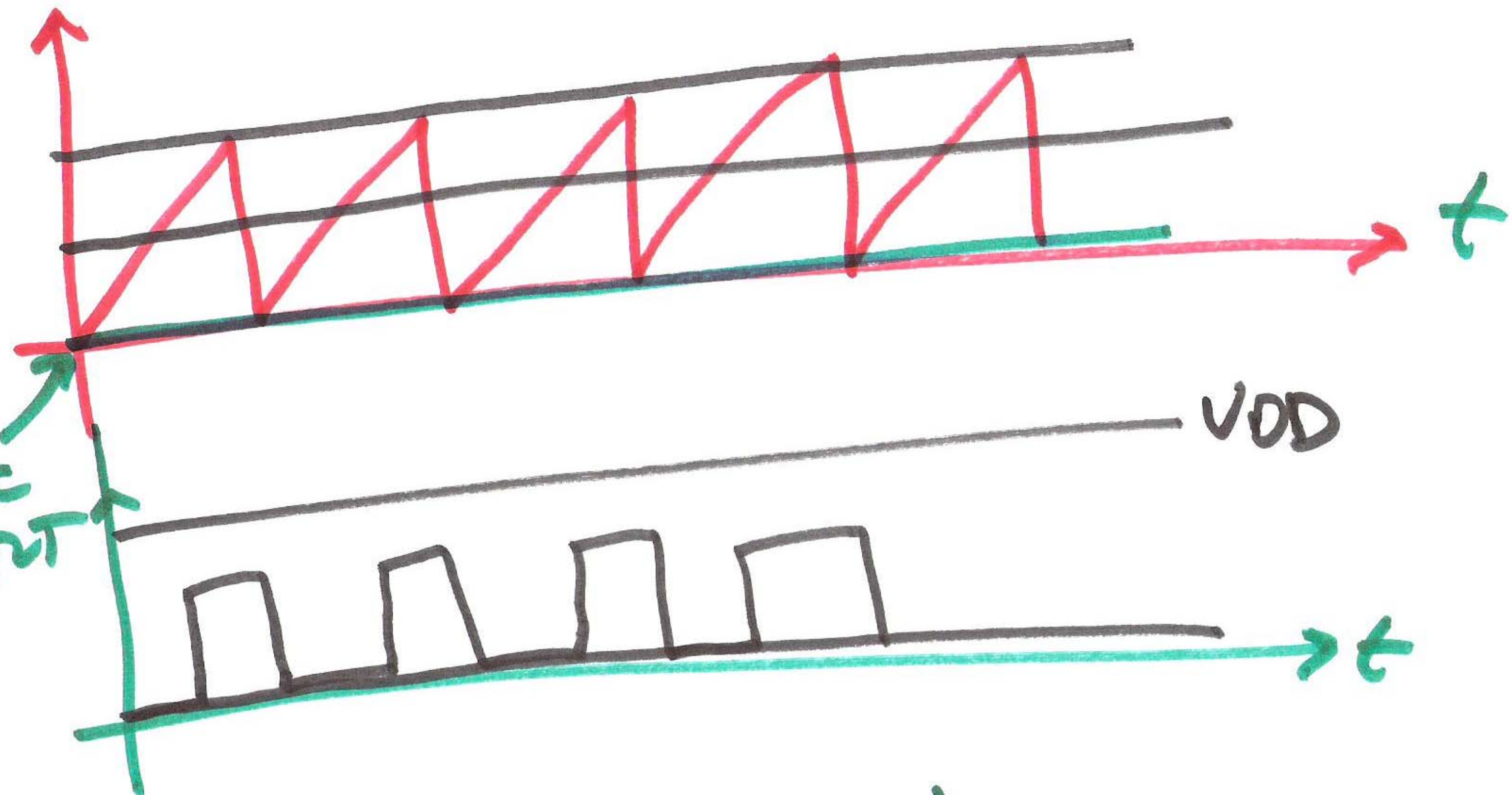


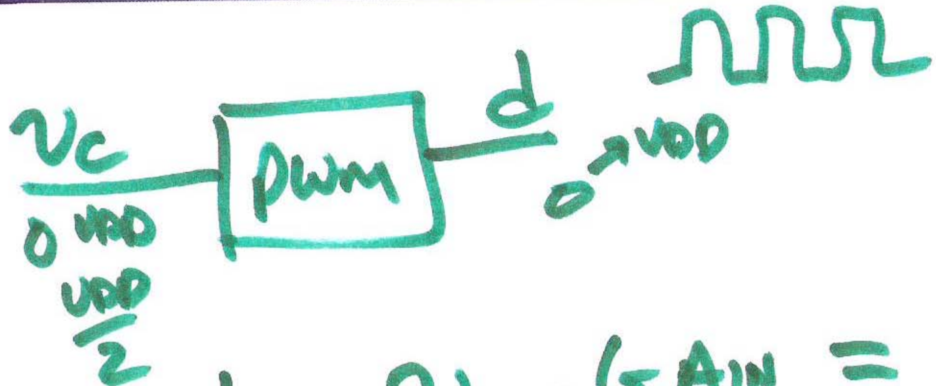
5)



$$\frac{\text{OUTPUT}}{\text{INPUT}} = \frac{d}{v_c} = \frac{1}{VDD}$$

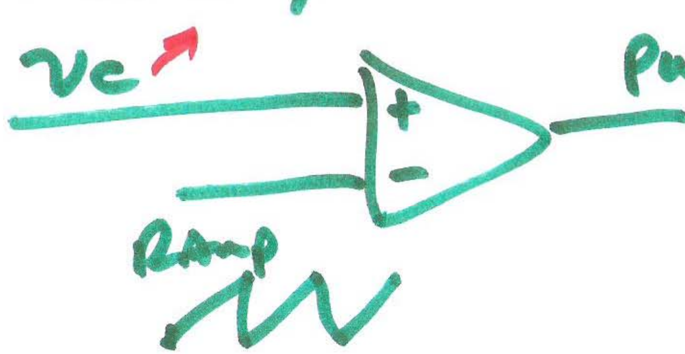
$$d = \frac{v_c}{VDD}$$

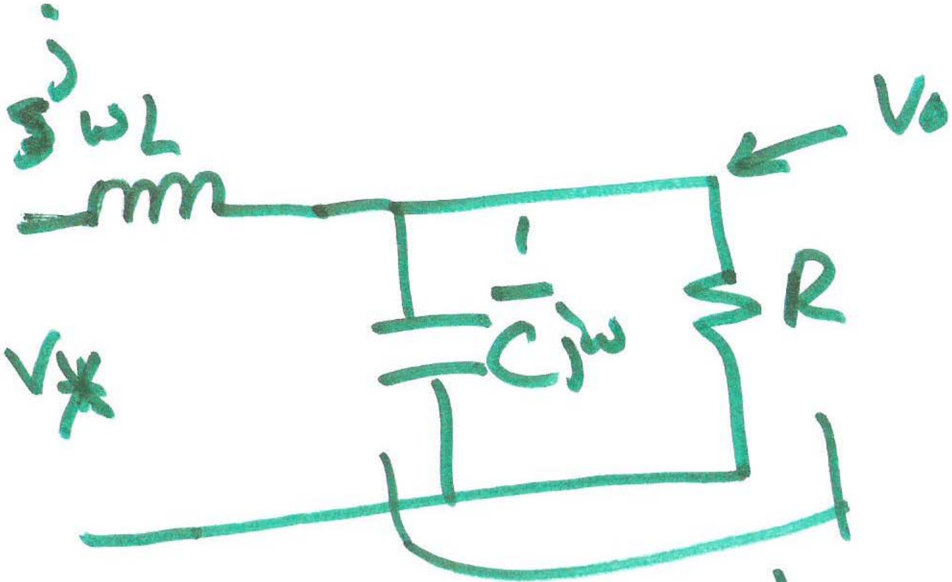
6)



$$d = v_c \cdot GAIN = v_c \cdot \frac{1}{VDD}$$

$$1/3 = 33\% \,,\; v_c = 0.33\,VDD = \frac{VDD}{3}$$





$$\frac{R \cdot \frac{1}{jwC}}{R + \frac{1}{jwC}} = \frac{R}{1 + jwRC}$$

$$V_O = V_x \cdot \frac{\frac{R}{1+jwRC}}{\frac{R}{1+jwRC} + jwL} = \frac{V_x \cdot R}{\frac{R}{R} + \frac{sL}{R}(1 + sRC)}$$

8)

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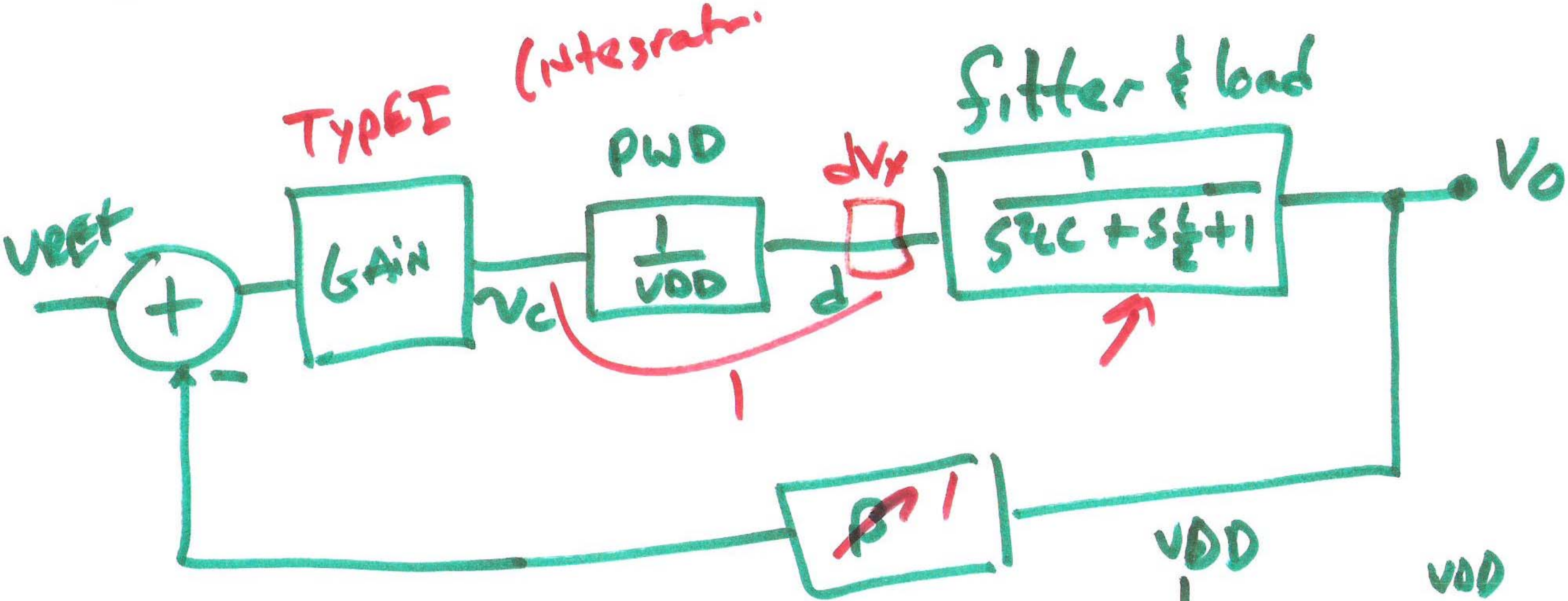
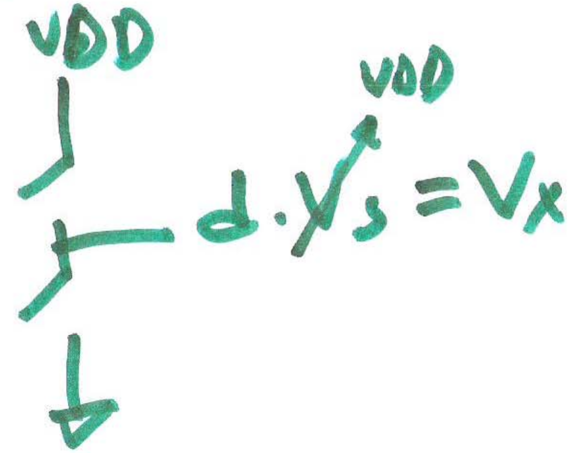
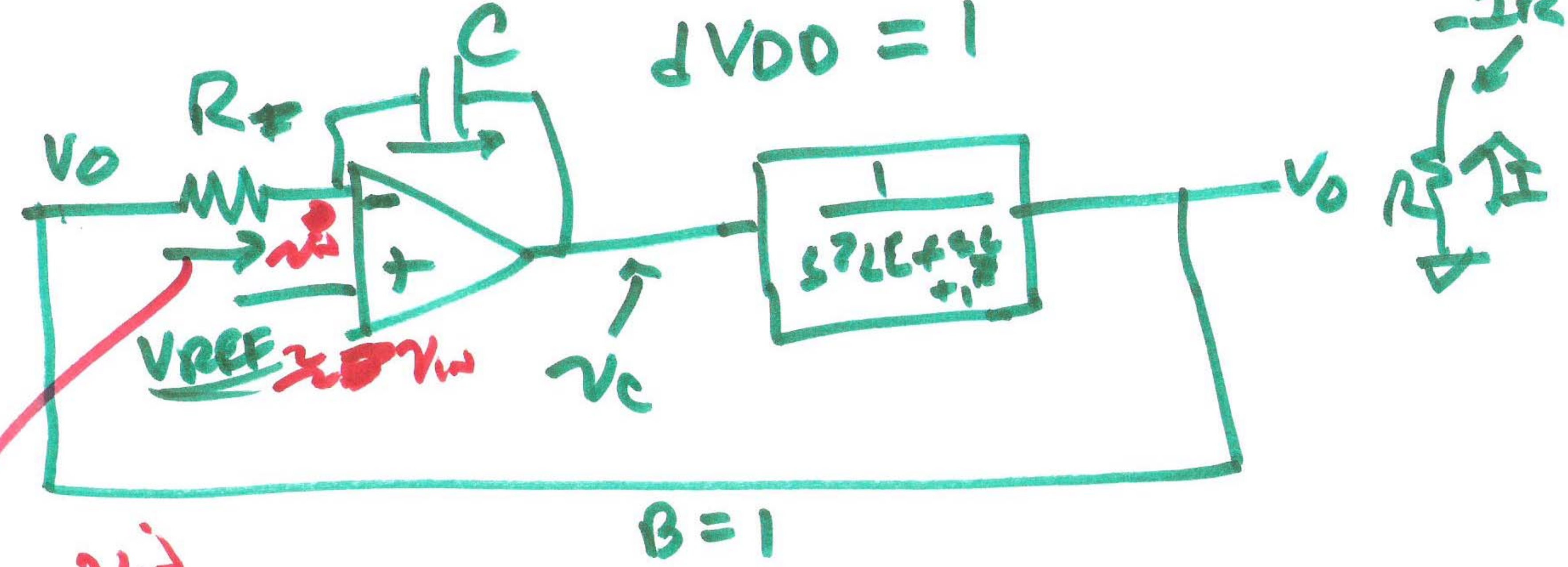
$$\frac{V_O}{d \cdot VDD} = \frac{V_O}{V_x} = \frac{1}{s^2 LC + s\frac{L}{R} + 1}$$







$$\frac{v_o - v_{in}}{R}$$

$$\underbrace{-\left(\frac{V_o - v_{in}}{R}\right)\frac{1}{j\omega C}}_{v_c} \cdot \left(\frac{1}{s^2LC + s\frac{L}{R} + 1}\right) = V_o$$

$$-\left(\frac{v_o - v_{in}}{R}\right)\frac{1}{j\omega C}\cdot\frac{1}{\left(s^2LC + s\frac{L}{R} + 1\right)} = v_o$$

$$\frac{-\left(v_o - v_{in}\right)}{sRC\left(s^2LC + s\frac{L}{R} + 1\right)} = v_o$$

$$\frac{-\left(v_o - v_{in}\right)}{s^3LRC^2 + s^2LC + sRC} = v_o$$

3-poles 1 at DC

don't use Type I L.F.