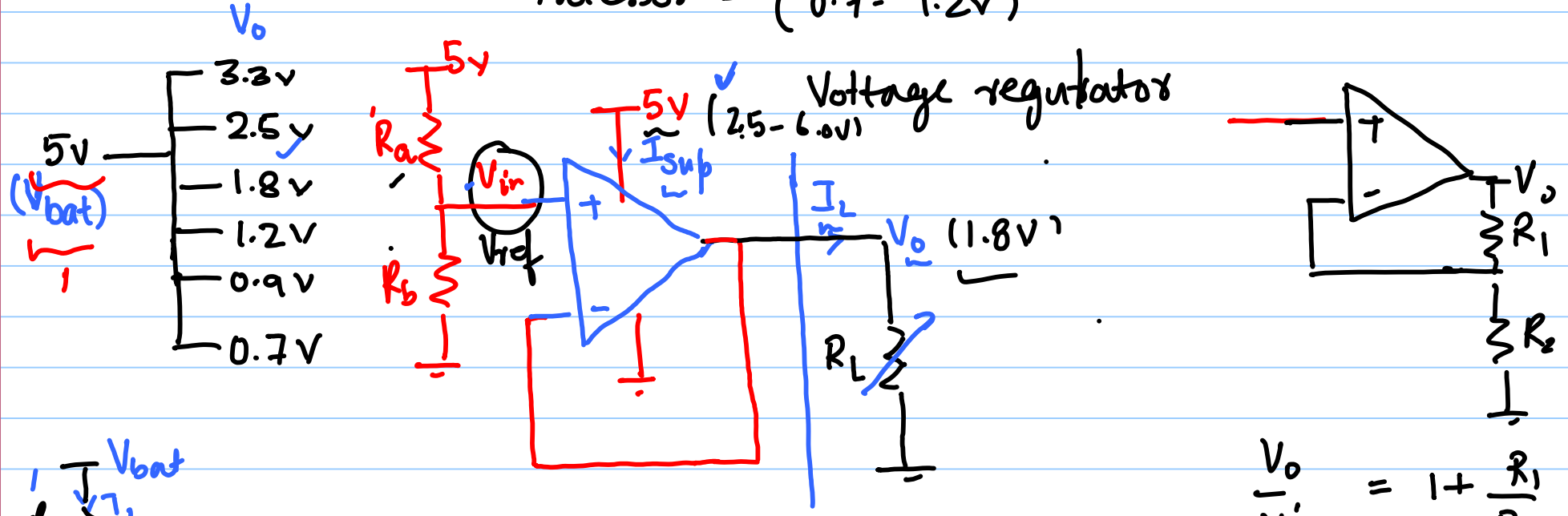
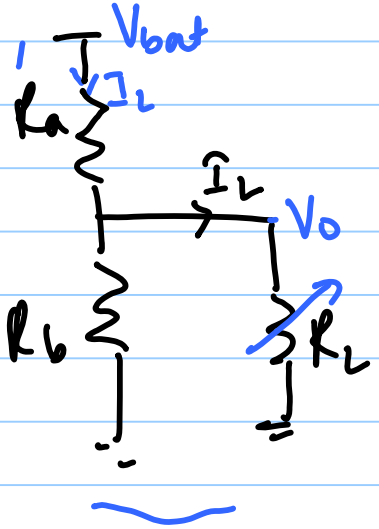
Note Title

# lecture # 23

17-03-2021

Cell phone : (5V) — Transmitter / Receiver (3.3V, 1.8V, 0.9V)
— Audio / Video
— GPS
— Processor — (0.7 - 1.2V)

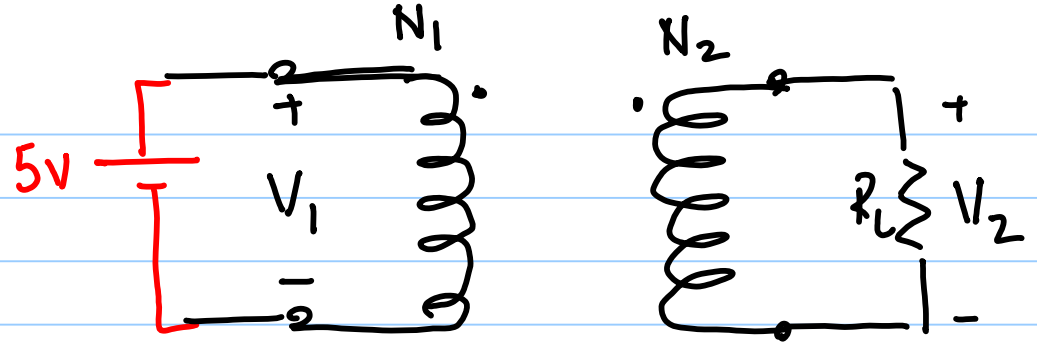


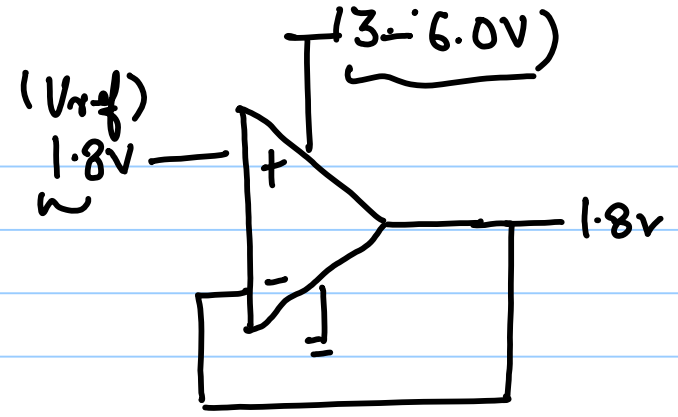




$$\frac{V_o}{V_{in}} = 1 \Rightarrow V_o = \frac{R_b}{R_b + R_a} V_{bat}$$

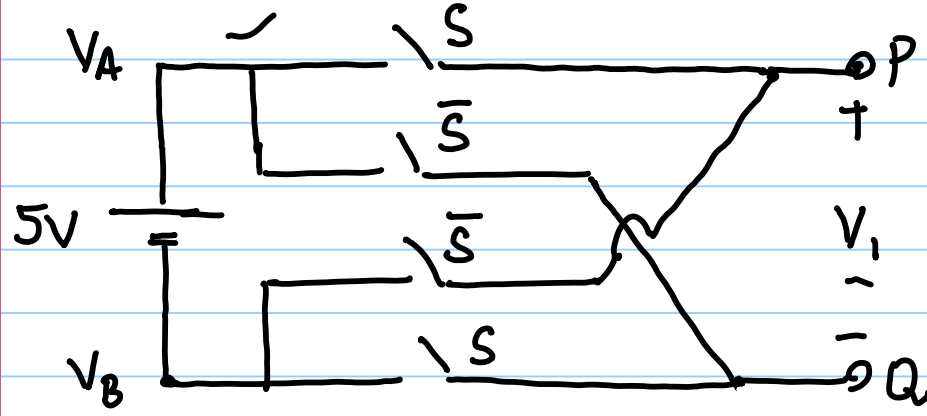
$$\frac{V_o}{V_{in}} = 1 + \frac{R_1}{R_2}$$

Power Efficiency = $\dfrac{\text{Power delivered to load}}{\text{Power drawn from supply}}$



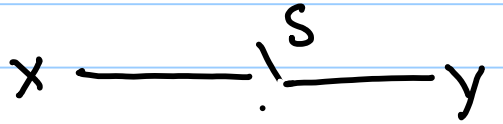




$$\frac{V_1}{N_1} = \frac{V_2}{N_2} \Rightarrow V_2 = \frac{N_2}{N_1} \cdot V_1$$

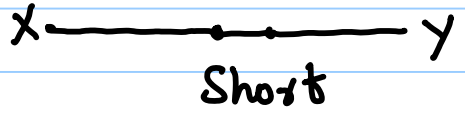



$V_1 = V_P - V_Q$

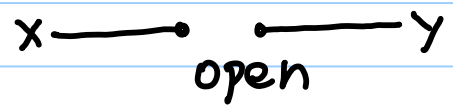
$5V = V_A - V_B$

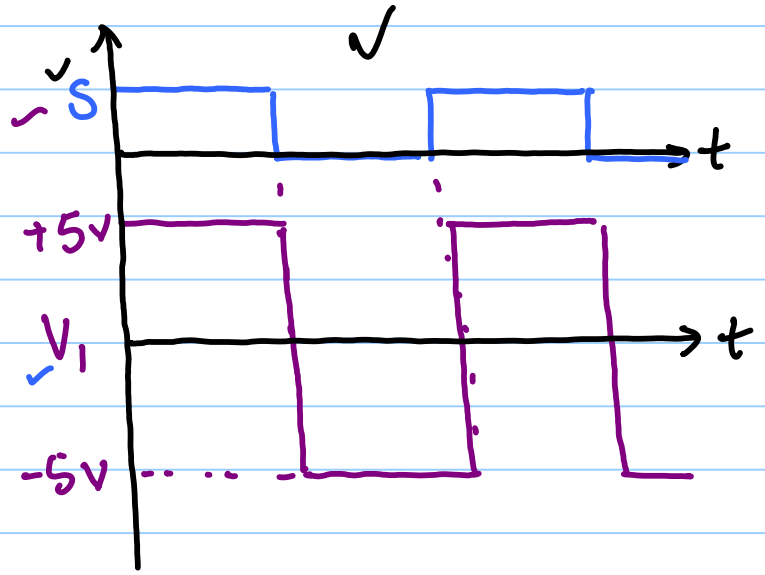


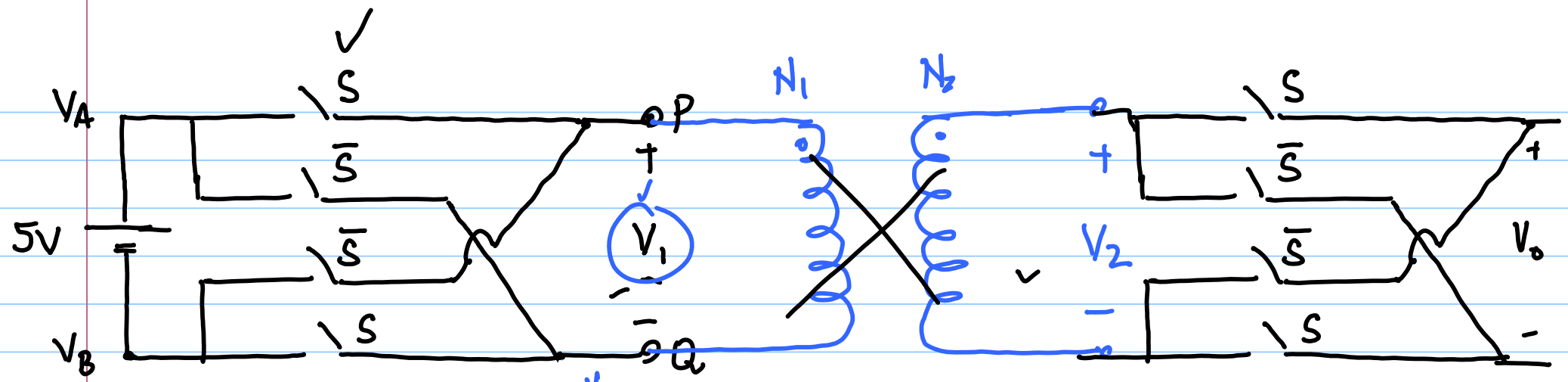

$S=1, \bar{S}=0$ ✓

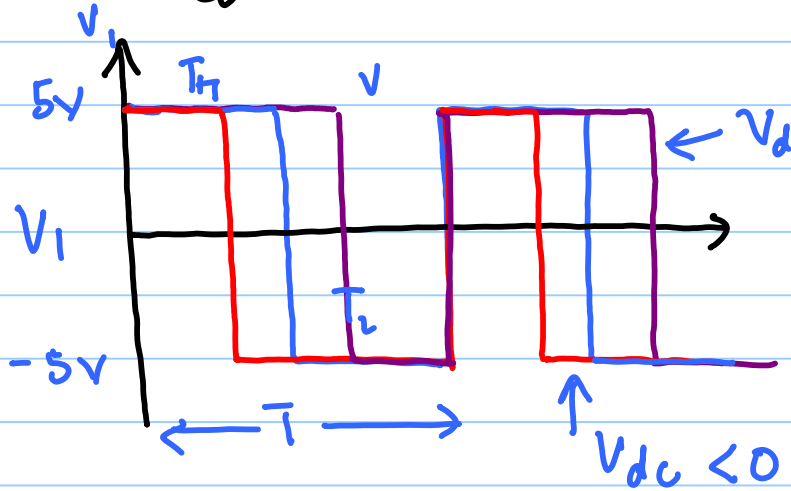


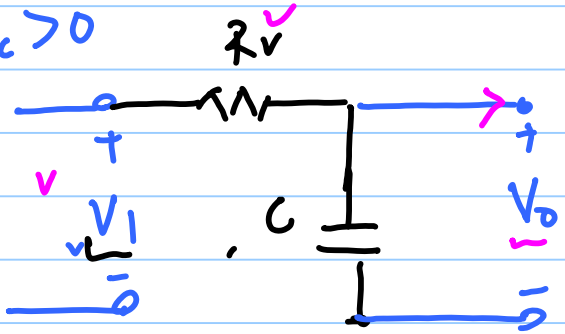

$S=0, \bar{S}=1$ ✓



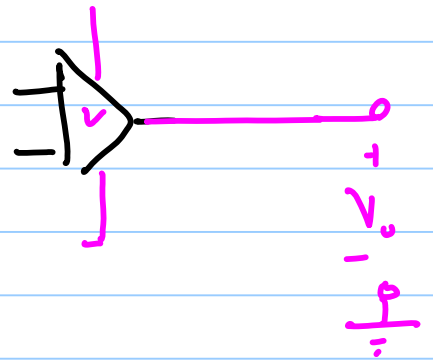





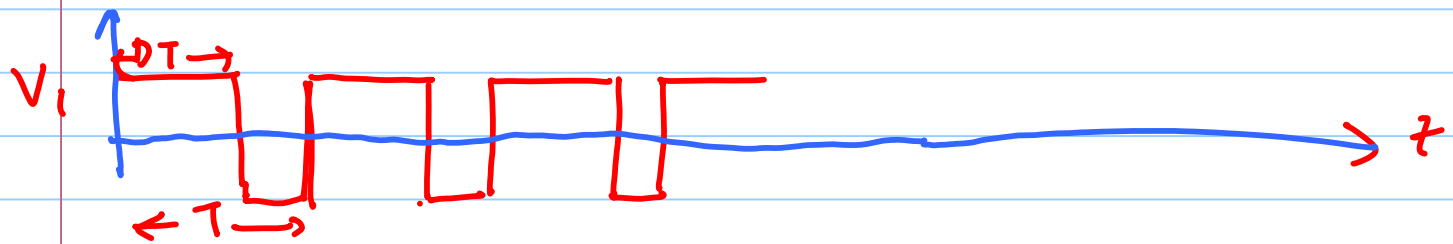



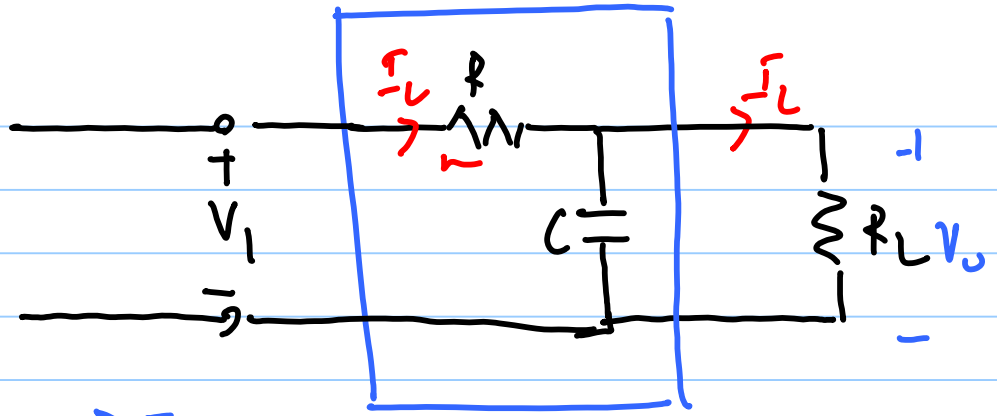




$$\frac{T}{2} = T_H = T_L$$

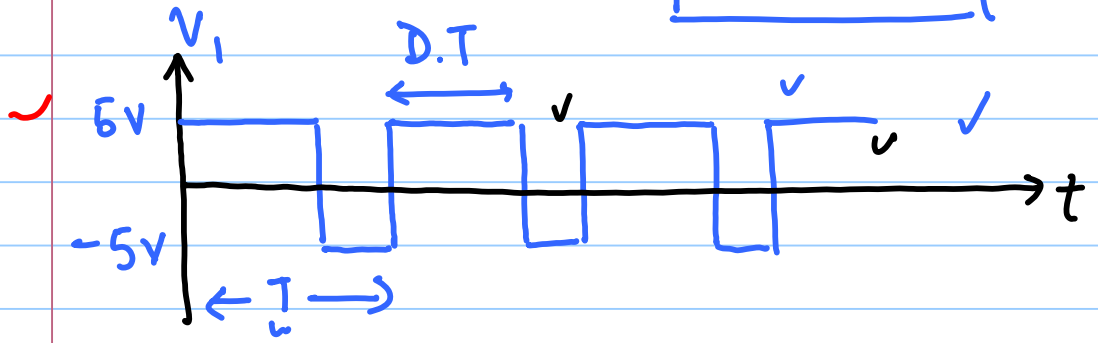


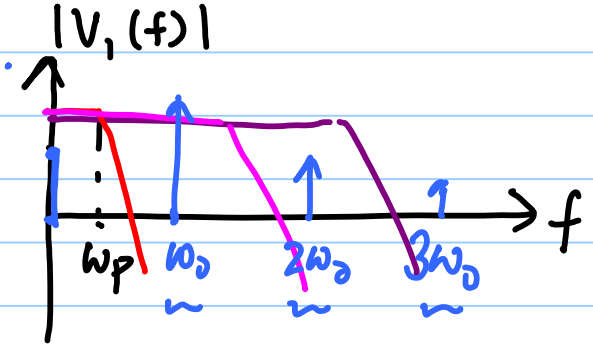

$$\text{Duty Cycle } (D) = \frac{T_H}{T_H + T_L} = \frac{T_H}{T}$$






$$\frac{V_o}{V_1} = \frac{\left(R_L \,||\, \frac{1}{sC}\right)}{R + \left(R_L \,||\, \frac{1}{sC}\right)}$$



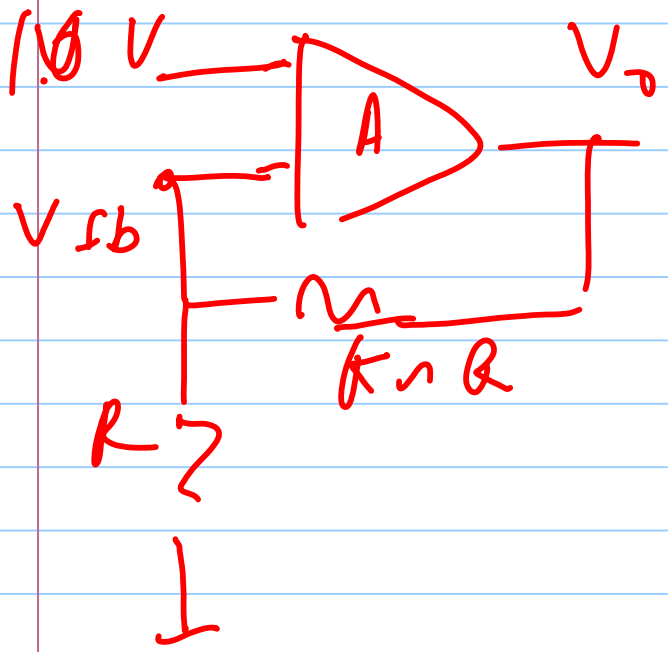

$$V_1(t) = \sum a_n \cos(n\omega_0 t) + b_n \sin(n\omega_0 t)$$

DC: $a_0$

$$n\omega_0 = n\left(\frac{2\pi}{T}\right)$$

$$\frac{V_o}{V_1} = \frac{R_L \,/\, 1+sR_LC}{R + \frac{R_L}{1+sR_LC}}$$

$$= \frac{R_L}{R + R_L + sR_LRC}$$




$$\frac{V_o}{V_i} = \frac{R_L \,/\!/\, (R+R_L)}{1 + s \underbrace{\frac{R_L R}{R_L+R}} C}$$

DC gain: $\frac{R_L}{R_L+R} \approx 1$

$$\omega_p = \frac{1}{\underbrace{\frac{R_L R}{R_L+R}} \underbrace{C}} \ll \omega_0$$

$V_{in}$ sets up the operating point of non-linear block.

$$V_o = f(V_{in})$$

$$= a_0 + a_1 V_{in} + a_2 V_{in}^2 + a_3 V_{in}^3 + \cdots$$

$$V_o' = f(V_{in} + \Delta V_{in})$$

$$V_o + \Delta V_o = a_0 + a_1 (V_{in} + \Delta V_{in}) + a_2 (V_{in} + \Delta V_{in})^2 + \cdots$$

$$= (a_0 + a_1 V_{in} + a_2 V_{in}^2 + \cdots)$$

$$+ a_1 \cdot \Delta V_{in} + a_2 \Delta V_{in}^2 + \cdots$$

$$\Delta V_o = a_1 \cdot \Delta V_{in} + \underbrace{a_2 \Delta V_{in}^2 + \cdots}_{\text{neg.}}$$

$$\boxed{\Delta V_o = a_1 \cdot \Delta V_{in}}$$

"In Simulation"