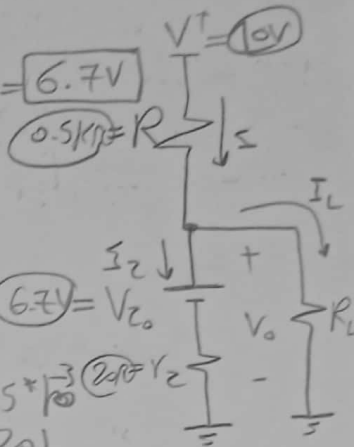
Hand written Assignment #4

1) $V_z = 6.8V$
$I_z = 5mA$
$r_z = 20\Omega$
$I_{zk} = 0.2mA$
$V^+ = 10V$ (±1V)
V_o = ? with no load
V^+ @ its nominal value

$V_{z_o} = V_z - I_z R_z = 6.8 - (5*10^{-3} * 20) = 6.7V$



with no load:

$I_z = I = \frac{V^+ - V_{z_o}}{R + r_z} = \frac{10 - 6.7}{0.5 + 0.02} = 6.35mA$

$\therefore V_o = V_{z_o} + I_z r_z = 6.7 + (6.35 * 10^{-3} * 20)$

$V_o = 6.83V$ #

(b) for ±1V change in $V^+ \rightarrow V_o$ change with $\Delta V_o = \Delta V^+ \frac{r_z}{R + r_z}$

$\Delta V_o = \pm 1 \frac{20}{500 + 20} = \pm 38.5mV$

∴ Linear reg. = 38.5 mV/V #

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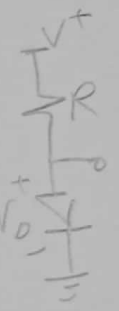
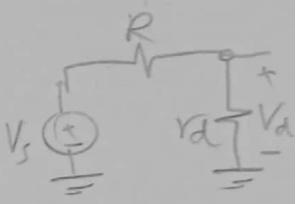
2) $R = 10K\Omega$, $V^+ = 16V$, $f = 60Hz$, 1V peak, V_{DC} @ = ?, V_{amp} = ?. $V_D = 0.7V$ @1mA

Solution





$I_D = \frac{V_{DD} - V_D}{R} = \frac{10 - 0.7}{10} = 0.93mA$

Since this value is very close to 1mA, diode voltage will be very close to (0.7V).

@ op, $r_d = \frac{V_T}{I_D} = \frac{25}{0.93} = 26.9\Omega$

⇒ Small signal model (to get V_o)

$V_d(peak) = \hat{V}_s \frac{r_d}{R + r_d} = 1 \frac{0.0269}{10 + 0.0269} = 2.68mV$ Small

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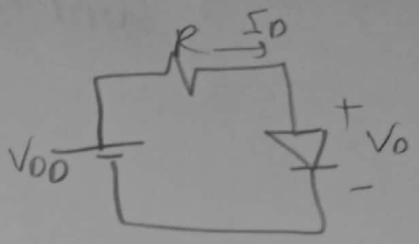
3 $V_{DD}=5V$, $R=1K\Omega$, $V_D=0.7V$



Solution

$$I_D=\frac{V_{DD}-V_D}{R}=\frac{5-0.7}{1000}=\frac{4.3}{1000}=\boxed{4.3mA}$$

To obtain better estimate of V_D

$$V_2-V_1=2.3V_T\log\left(\frac{I_2}{I_1}\right)$$

$2.3V_T=60mV$ $\quad\therefore V_2=V_1+0.06\log\left(\frac{I_2}{I_1}\right)$

$V_1=0.7V$, $I_1=1mA$, $I_2=4.3mA \rightarrow V_2=\boxed{0.738V}$

$$I_D=\frac{5-0.738}{1}=\boxed{4.262mA}$$

$$V_2=0.738+0.06\log\left[\frac{4.262}{4.3}\right]=\boxed{0.738V}$$

$\boxed{I_D=4.262mA}$ $\boxed{V_D=0.738V}$ close to 1st iteration values

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