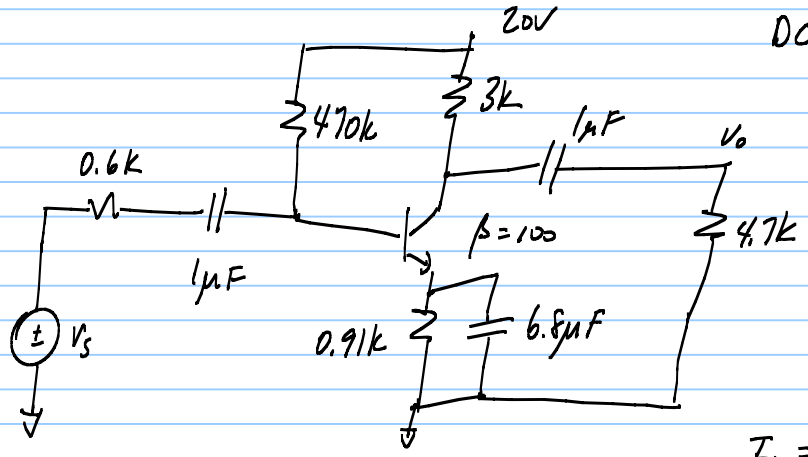
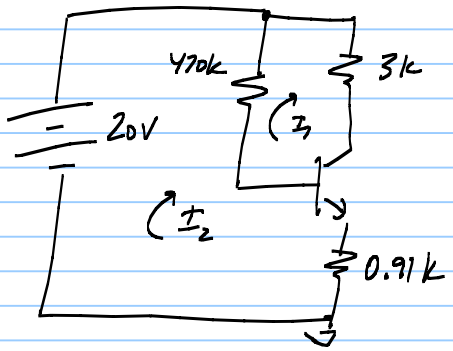
Chapter 9 #28 a, b, 31 a-c

Note Title 8/12/2018

28)



DC



$I_1 = 100(I_2 - I_1)$ $\quad 0 = -101 I_1 + 100 I_2$

$20 - 0.7 = (I_2 - I_1)470k + 0.91k I_2$

$19.3 = -470 I_1 + 470.91 I_2$

$I_1 = 3.435\,mA$ $\quad I_2 = 3.469\,mA = I_E$

$r_e = \frac{0.026}{3.469mA} = 7.495\Omega$

$A_{v_{NL}} = \frac{-R_c}{r_e} = \frac{-3k}{7.495} = -400$

$A_{v_L} = \frac{-R_c \| R_L}{r_e} = \frac{-3k \| 4.7k}{7.495} = -244.3$

$r_{in} = 470k \| \beta r_e = 748\,\Omega$

$r_{out} = 3k$

$C_{w_i} = 7pF$ $\quad C_{bc} = 6pF$ $\quad C_{M_i} = (1 - A_{v_L}) C_{bc}$ $\quad C_{M_o} \cong C_{bc}$

$C_{w_o} = 11pF$ $\quad C_{be} = 20pF$ $\quad = (245.3)(6pF)$ $\quad C_{M_o} = 6pF$

$C_{cc} = 10pF$ $\quad C_{M_i} = 1472pF$

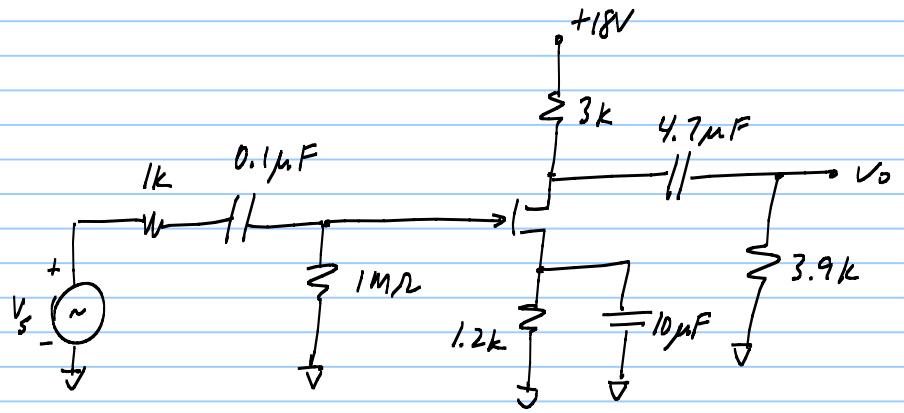
determine f_{H_i} & f_{H_o} & f_β

$$f_{H_i} = \frac{1}{2\pi(R_s \| r_{in})(C_{w_i} + C_{be} + C_{M_i})} = \frac{1}{2\pi(600 \| 748)(7pF + 20pF + 1472pF)} = 318.9\,KHz$$

$$f_{H_o} = \frac{1}{2\pi(r_o \| R_L)(C_{w_o} + C_{cc} + C_{M_o})} = \frac{1}{2\pi(3k \| 4.7k)(11pF + 10pF + 6pF)} = 3.22\,MHz$$

$$f_\beta = \frac{1}{2\pi \beta r_e (C_{be} + C_{bc})} = \frac{1}{2\pi(100)(7.5)(20pF + 6pF)} = 8.16\,MHz$$

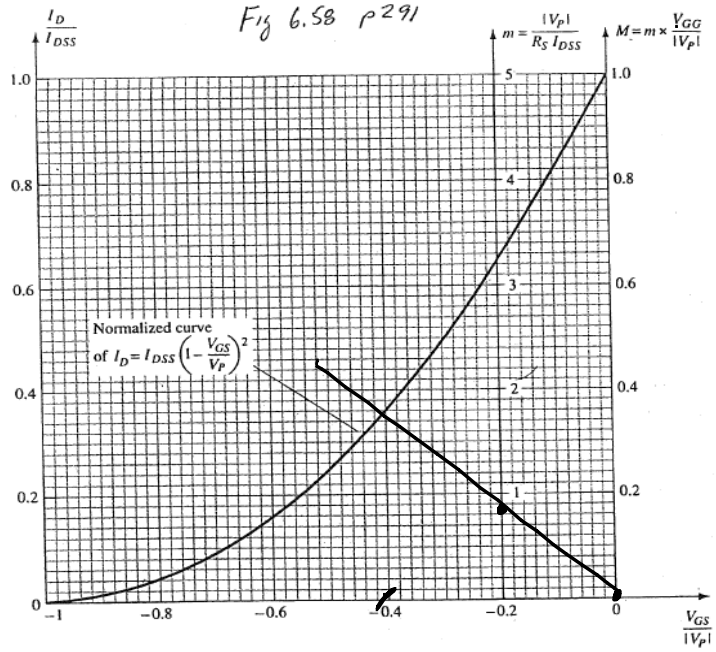
31)



$I_{DSS} = 6mA$

$V_p = -6$, $r_d = \infty\ \Omega$

Fig 6.58 p291



$V_{GG} = 0V$

$m = \frac{6}{1.2K \ 6mA} = 0.833$

$M = 0.833 \ \frac{0}{6} = 0$

$V_{GSQ} = (-0.4)(6) = -2.4V$

$g_m = \left(\frac{2 I_{DSS}}{|V_p|}\right)\left(1 - \frac{V_{GSQ}}{V_p}\right) = \frac{2(6mA)}{6}\left(1 - \frac{-2.4}{-6}\right)$

$g_m = 1.2 mS$

$A_{V_L} = -g_m (R_o \| R_L) = -1.2m\,(3k \| 3.9k) = -2.03$

$Z_{in} = 1M\Omega$

$Z_{out} = 3k$

$C_{w_i} = 3pF$ $\quad C_{gd} = 4pF$ $\quad C_{M_i} = (1 - A_{V_L}) C_{gd} = (1+2)(4pF) = 12pF$

$C_{w_o} = 5pF$ $\quad C_{gs} = 6pF$ $\quad C_{M_o} = \left(1 - \frac{1}{A_{V_L}}\right) C_{gd} = \left(1 + \frac{1}{2}\right)(4pF) = 6pF$

$C_{ds} = 1pF$

$f_{Hi} = \frac{1}{2\pi (R_s \| r_{in})(C_{w_i} + C_{gs} + C_{M_i})} = \frac{1}{2\pi (1k \| 1M)(3pF + 6pF + 12pF)} = 7.59 MHz$

$f_{Ho} = \frac{1}{2\pi (R_o \| R_L)(C_{w_o} + C_{ds} + C_{M_o})} = \frac{1}{2\pi (3k \| 3.9k)(5pF + 1pF + 6pF)} = 7.82 MHz$