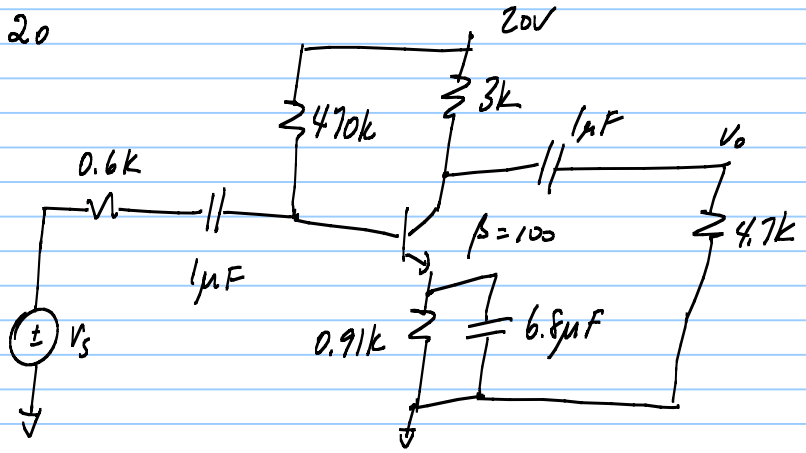
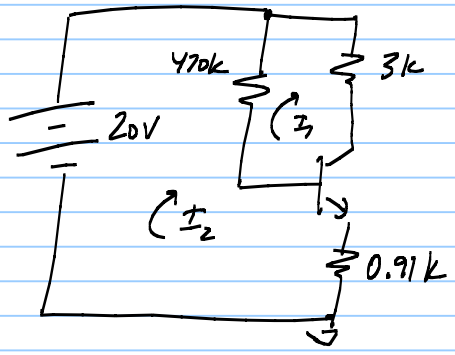
Chapter 9 20 a-e, 23 a-e

Note Title 8/12/2018

20



DC



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

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

$19.3 = -470 I_1 + 470.91 I_2$

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

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

$A_{v_{MID}} = \frac{-R_C}{r_e} = \frac{-3k}{7.495} = -400$

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

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

$r_{out} = 3k$

Determine f_{L_S}, f_{L_C} & f_{L_E}

$f_{L_S} = \frac{1}{2\pi(600 + 748)(1\mu F)} = 118\,Hz$ $\quad f_{L_C} = \frac{1}{2\pi(3k + 4.7k)(1\mu F)} = 20.7\,Hz$

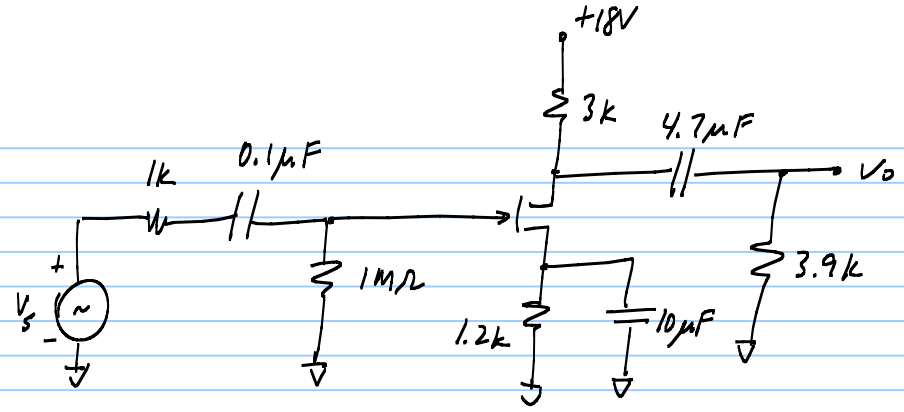
$f_{L_E} = \frac{1}{2\pi R_e C_e}$ $\quad R_e = 3k \| \left(\frac{470k \| 0.6k}{100} + 7.495 \right) = 3k \| (6 + 7.495) = 13.43\Omega$

$f_{L_E} = \frac{1}{2\pi(13.43)(6.8\mu)} = 1.742\,KHz$

Lower Cutoff frequency is the largest of f_{L_S}, f_{L_E} and f_{L_C}

$f_1 = f_{L_E} = 1.742\,kHz$

23)



$I_{DSS} = 6mA$

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

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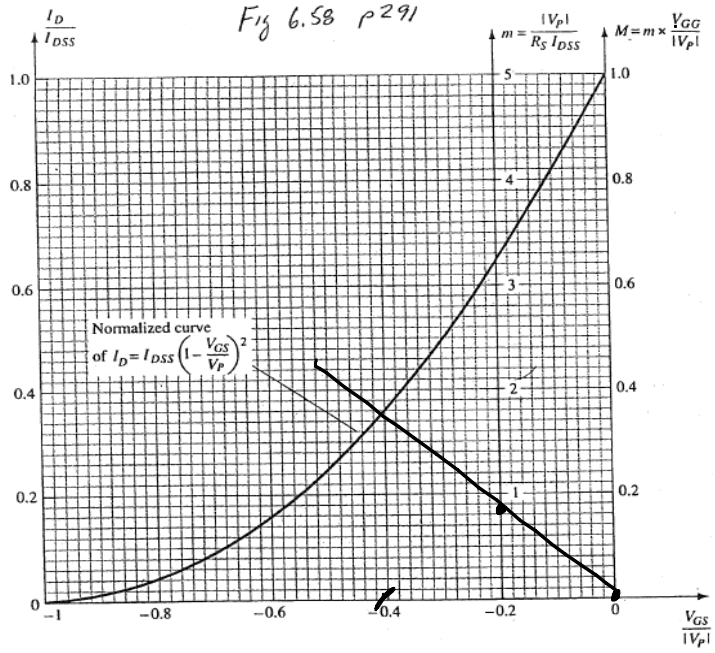

$V_{GG} = 0V$

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

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

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

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

$g_m = 1.2\,mS$

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

$Z_{in} = 1M\Omega$

$Z_{out} = 3k$

find f_{L_G}, f_{L_C} & f_{L_S}

$f_{L_G} = \frac{1}{2\pi(1M\Omega + 1k)(0.1\mu F)} = 1.59\,Hz$

$f_{L_C} = \frac{1}{2\pi(3k + 3.9k)(4.7\mu)} = 4.91\,Hz$

$R_{EQ} = R_S \| 1/g_m = 1.2k \| 1/1.2m = 491.8\Omega$

$f_{L_S} = \frac{1}{2\pi R_{EQ} C_S} = \frac{1}{2\pi(491.8)(10\mu F)}$

$f_{L_S} = 32\,Hz$

$\boxed{f_1 = 32\,Hz}$