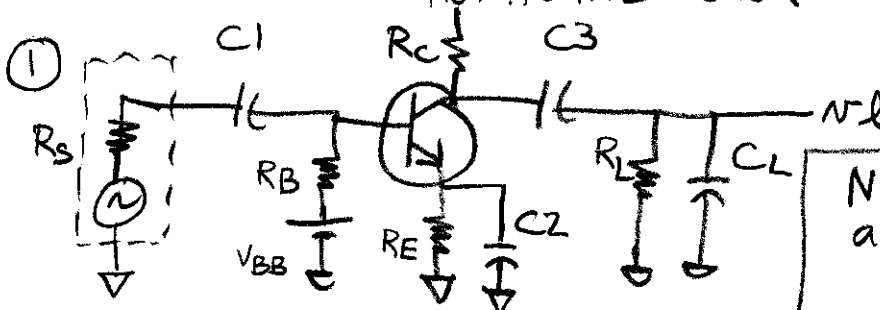


# FREQUENCY RESPONSE

+15V HOMEWORK

12/2/07



Note: Bias Calculations are already done

$B = 150$ ,  $c_{bc} = 2 \text{ pF}$ ,  $c_{be} = 10 \text{ pF}$ ,  $r_e = 2.9 \Omega$   
 $R_s = 50 \Omega$   $R_B = 1.5 \text{ k}$   $R_E = 100$   $R_C = 1 \text{ k}$   $R_L = 2 \text{ k}$   
 $C_1 = 4.7 \mu\text{F}$   $C_2 = 1000 \mu\text{F}$   $C_3 = 47 \mu\text{F}$   $C_L = 22 \text{ pF}$

Find the net low and high cutoff frequencies.

Answers:  $F_{cl1} = 87.1 \text{ Hz}$   $F_{cl2} = 54.9 \text{ Hz}$   $F_{cl3} = 112.9 \text{ Hz}$   
(input) (emitter) (output)  
 $F_{clnet} \approx 153 \text{ Hz}$   $C_{miller} = 457 \text{ pF}$

$F_{ch1} = 7.8 \text{ MHz}$   $F_{ch2} = 10.8 \text{ MHz}$   $F_{chnet} = 6.3 \text{ MHz}$   
(input) (output)

$A_{vl} = 228$   
 $r_{bt} = 438 \Omega$   
 $R_{in} = 339 \Omega$

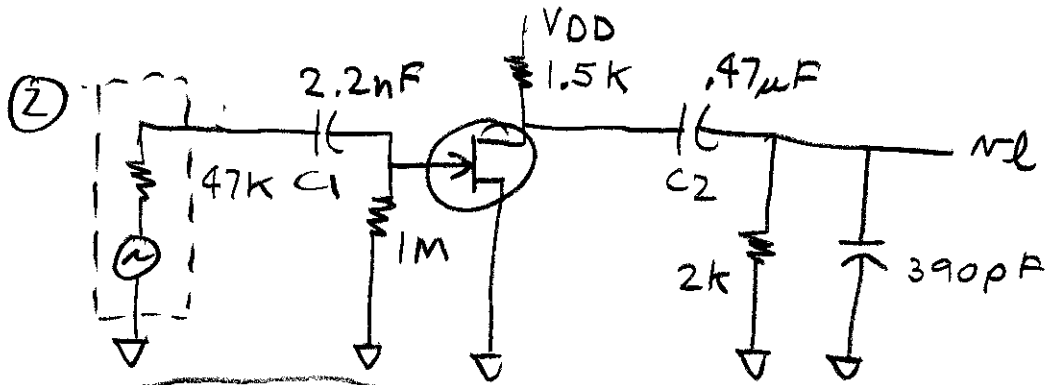
$C_{in} = 467 \text{ pF}$

Design problem: Determine  $C_1$ ,  $C_2$ , &  $C_3$  for an  $F_{clnet} = 20 \text{ Hz}$

Answers: (standard values)  $C_1 = 47 \mu\text{F}$   $C_2 = 6800 \mu\text{F}$   $C_3 = 6.8 \mu\text{F}$

$20 \times .51 = 10.2 \text{ Hz}$

$(5380 \mu\text{F})$   $(5.2 \mu\text{F})$   
Calc Calc



$g_{m0} = 0.008$

$C_{gd} = 1 \text{ pF}, C_{gs} = 3 \text{ pF}$

Note: Bias calculation already done

Find the net low and high cutoff frequencies

Answers:  $F_{cl1} = \frac{69.1 \text{ Hz}}{\text{(input)}}$

$F_{cl2} = \frac{96.8 \text{ Hz}}{\text{(output)}}$

$F_{clnet} \approx 119 \text{ Hz}$

$A_{vL} = -0.008 \times \frac{1.5k \parallel 2k}{857} = 6.86$

$C_{miller} = 7.86 \text{ pF}$

$C_{input} = 10.86 \text{ pF}$

$F_{ch1} = \frac{327 \text{ kHz}}{\text{(input)}}$

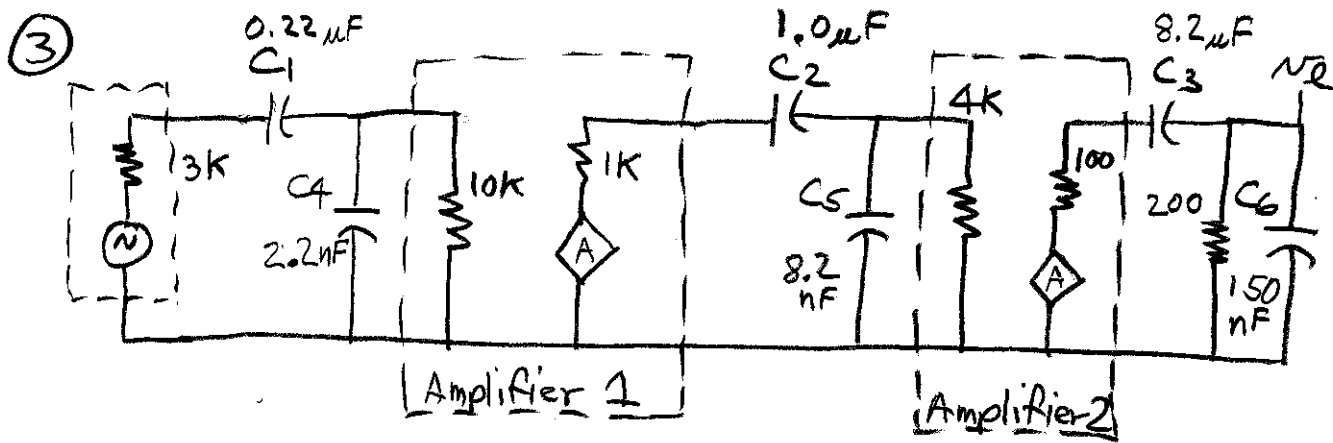
$F_{ch2} = \frac{476 \text{ kHz}}{\text{(output)}}$

$F_{chnet} \approx 270 \text{ kHz}$

Design Problem: Determine  $C_1$  +  $C_2$  for an  $F_{clnet} = 20 \text{ Hz}$

Answers: (standard values)  $C_1 = 12 \text{ nF}$   $C_2 = 3.9 \text{ uF}$

$20 \times .644 = 12.9 \text{ Hz} = F_L$



Find the net low and high cutoff frequencies

Answers:  $F_{cl1} = \frac{55.7 \text{ Hz}}{\text{input}}$   $F_{cl2} = \frac{31.8 \text{ Hz}}{\text{middle}}$   $F_{cl3} = \frac{64.7 \text{ Hz}}{\text{last}}$

$F_{clnet} \approx \underline{91 \text{ Hz}}$

$F_{ch1} = \frac{31.4 \text{ kHz}}{\text{input}}$   $F_{ch2} = \frac{24.3 \text{ kHz}}{\text{middle}}$   $F_{ch3} = \frac{15.8 \text{ kHz}}{\text{last}}$

$F_{chnet} \approx \underline{12.2 \text{ kHz}}$

Design problem: Determine  $C_1, C_2, C_3$  for an  $F_{clnet} = 20 \text{ Hz}$ . Determine  $C_4, C_5, C_6$  for an  $F_{chnet} = 20 \text{ kHz}$

Answers (std values) (52 uF calc)

$C_1 = \underline{1.2 \mu\text{F}}$   $C_2 = \underline{3.3 \mu\text{F}}$   $C_3 = \underline{68 \mu\text{F}}$

$C_4 = \underline{1.5 \text{ nF}}$   $C_5 = \underline{4.7 \text{ nF}}$   $C_6 = \underline{56 \text{ nF}}$

$20 \times 0.51 = \underline{10.2 \text{ Hz}}$   $F_L$  — round C up

$\frac{20 \text{ kHz}}{0.51} = \underline{39.2 \text{ kHz}}$   $F_H$  — round C down