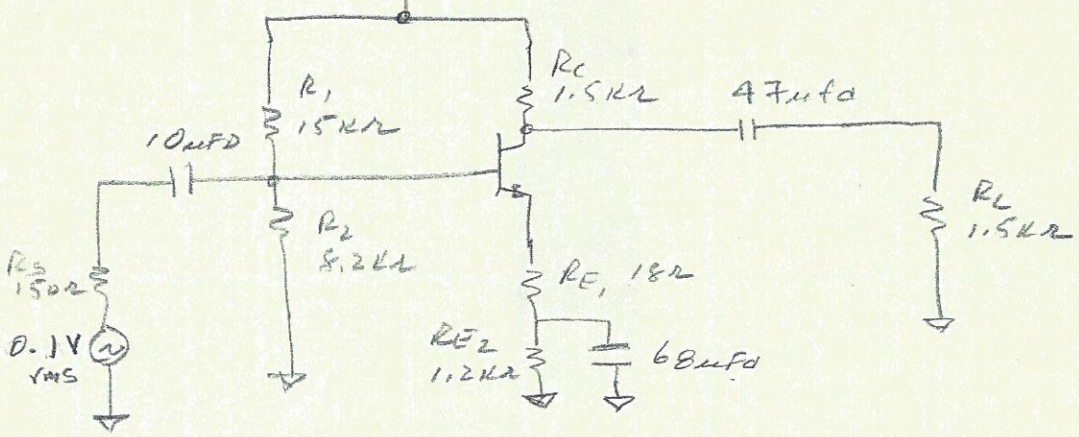
CE AMP - EXAMPLE #3
W/ AC LOAD LINE

$V_{CC} = 25V$

$\beta_{AC} = \beta_{dc} = 185$



dc CALCS:

$$V_B = \left(\frac{R_2}{R_1+R_2}\right)V_{CC} = 8.836V$$

$$V_E = V_B - V_{BE} = 8.136V$$

$$I_E = \frac{V_E}{R_{E1}+R_{E2}} = \frac{8.136V}{1218\Omega} = 6.68mA$$

$$I_B \simeq \frac{V_B}{\beta_{dc} R_E} = \frac{8.836}{(185)(1218\Omega)} = 0.039mA$$

$I_{CQ} \rightarrow$ $I_C = I_E - I_B = 6.68mA - 0.039mA = \boxed{6.64mA}$

$$V_C = V_{CC} - I_C R_C = 25V - (6.64mA)(1.5k\Omega) = 15.04V_{dc}$$

$V_{CEQ} \rightarrow$ $V_{CE} = V_C - V_E = 15.04V - 8.136V = \boxed{6.904V}$

$$I_{C(SAT)} = \frac{V_{CC} - V_{BE}}{R_C + R_{E1} + R_{E2}} = \frac{25V - 0.7V}{2718\Omega}$$

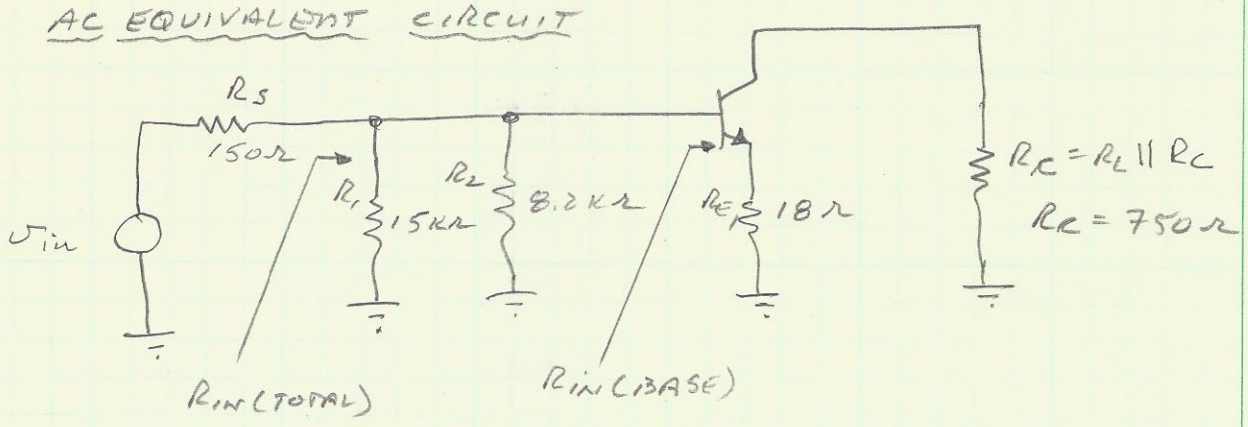
$$\boxed{I_{C(SAT)} = 8.94mA}$$

$$\boxed{V_{CE(C-O)} = V_{CC} = 25V}$$

$$r'_e = \frac{25mV}{I_E} = \frac{25mV}{6.68mA} = 3.74\Omega$$

AC ANALYSIS

AC EQUIVALENT CIRCUIT



$$R_{IN(BASE)} = \beta_{AC}(r'_e + R_{E_1})$$
$$= 185(3.74\Omega + 18); \quad \boxed{R_{IN(BASE)} = 4.02K\Omega}$$

$$R_{IN(TOTAL)} = R_1 \parallel R_2 \parallel R_{IN(BASE)}$$
$$= 15K\Omega \parallel 8.2K\Omega \parallel 4.02K\Omega; \quad \boxed{R_{IN(TOTAL)} = 2.29K\Omega}$$

$$R_{OUT} = R_L = R_L \parallel R_C \qquad \boxed{R_L = 750\Omega}$$

$$A_V = [(R_L)/(r'_e + R_{E_1})] \qquad \boxed{A_V = 34.5}$$

$$ATTN = \frac{R_S + R_{IN(TOTAL)}}{R_{IN(TOTAL)}} \qquad \boxed{ATTN = 1.066}$$

$$A'_V = A_V \cdot (ATTN)^{-1}$$
$$= 34.5(1/1.066) \qquad \boxed{A'_V = 32.38}$$

$$V_{OUT} = A'_V \cdot V_{in}$$
$$= (32.38)(0.1\,V_{rms}) \qquad \boxed{V_{OUT} = 3.238\,V_{rms}}$$

$$I_S = [V_A/(R_S + R_{IN(TOTAL)})]; \quad \boxed{I_S = 40.9\mu A}$$

$$A_i = (I_L/I_S)$$
$$= [(3.238\,V_{rms}/750\Omega)/40.9\mu A] \qquad \boxed{A_i = 105.34}$$

$$A_P = A'_V \cdot A_i$$
$$= (32.38)\,105.34$$

$$A_P = 3.411(10^3) \qquad \boxed{A_P = 3.411(10^3)}$$

$$\hookrightarrow dB = 10\log_{10} A_P = 35.32\,dB$$

LOAD LINES : dc LOAD LINE VALUES: PLOTTED FROM RESULTS OF dc ANALYSIS

AC LOAD LINE: 2 VALUES NEEDED TO CONSTRUCT:

$i_{C(SAT)}$ AND $V_{CE(C-O)}$

NOTE: Q-pts (dc & AC) ARE COINCIDENT!

1.) $i_{C(SAT)} = I_{CQ} + \frac{V_{CEQ}}{R_C}$

$= 6.64mA + (6.904/750\Omega)$

$i_{C(SAT)} = 15.85mA$

2.) $V_{CE(CO)} = V_{CEQ} + I_{CQ} \cdot R_C$

$= 6.904V + (6.64mA \cdot 750\Omega)$

$V_{CE(CO)} = 11.88V$