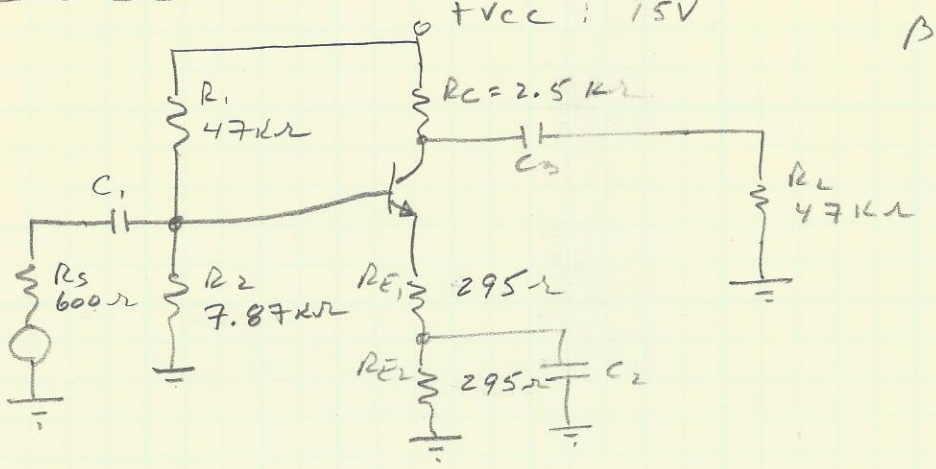
COMMON-EMITTER EXAMPLE #2
dc + AC (SIGNAL) ANALYSIS

$\beta_{dc} = 150$
$\beta_{AC} = 175$

$C_1 = C_3 = 10\,\mu f$
$C_2 = 100\,\mu F$



dc ANALYSIS

$V_B = \frac{R_2}{R_1 + R_2}$; $V_B = \left(\frac{7.87}{7.87 + 47}\right) 15V$ → $V_B = 2.15 V_{dc}$

$V_E = V_B - V_{BE}$; $V_E = 2.15 V_{dc} - 0.7V$ → $V_E = 1.45 V_{dc}$

$I_E = \frac{V_E}{R_{E1} + R_{E2}}$; $I_E = \frac{1.45 V_{dc}}{2(295\Omega)}$ → $I_E = 2.46 mA$

$I_C = I_{CQ} = I_E = 2.46 mA$

$V_c = V_{cc} - I_c R_c$; $V_c = 15V - (2.46mA \cdot 2.5k\Omega)$

$= 15V - 6.144V$ → $V_c = 8.86 V_{dc}$

$V_{CE} = V_c - V_E$; $V_{CE} = 8.86 V_{dc} - 1.45 V_{dc}$; → $V_{CE} = 7.41 V_{dc}$

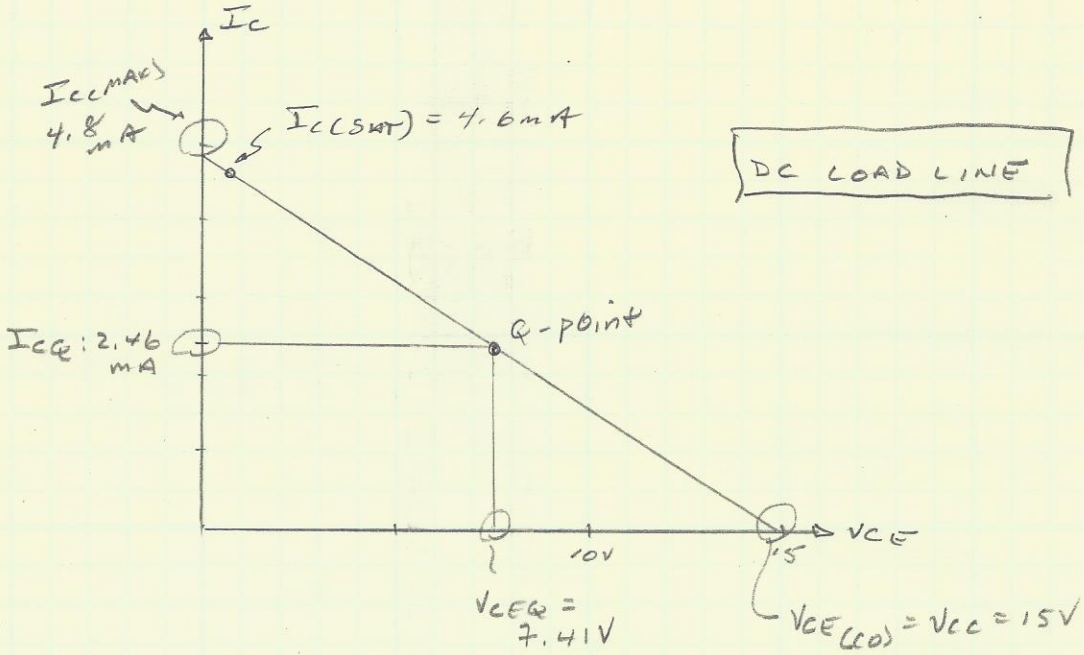
$V_{CE} = V_{CEQ} = 7.41 V_{dc}$

$I_{C(SAT)} = \frac{V_{cc} - 0.7}{R_c + R_{E1} + R_{E2}}$; $\frac{14.3V}{2.5k + 590\Omega}$; → $I_{C(SAT)} = 4.6 mA$

$I_{C(mAC)}$ (for curve) : $\frac{15V}{2.5k + 550\Omega}$ → $I_{C(mAC)} = 4.85 mA$

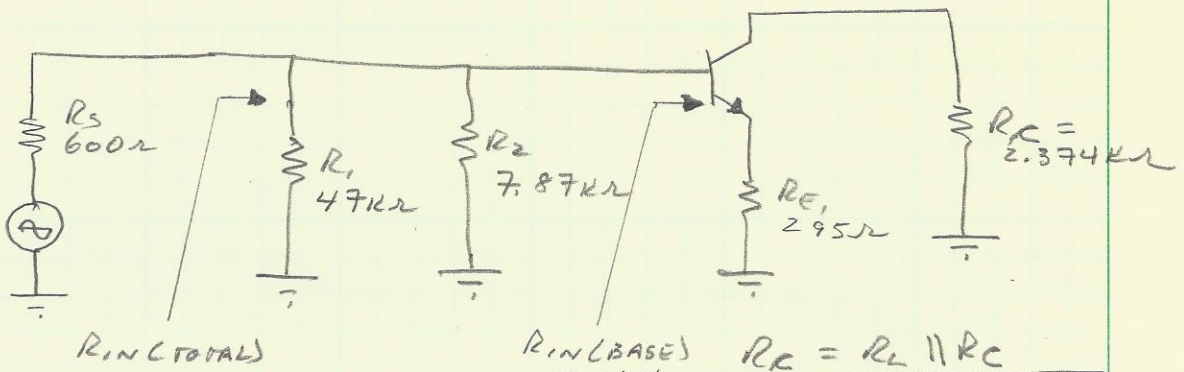
$r'e = \frac{25mV}{I_E} = \frac{25mV}{2.46mA}$; → $r'e = 10.163\Omega$

CE AMP STAGE - EXAMPLE #2



AC ANALYSIS ; $\beta_{AC} = 175$

AC EQUIVALENT CIRCUIT (W/ INPUT SOURCE)



$R_L = R_L \parallel R_C$

$R_L = 2.374 k\Omega$

$R_{IN(BASE)} = \beta_{AC}(r'_e + R_{E_1})$

$= 175(10.163 + 295\Omega)$; $R_{IN(BASE)} = 53.404 k\Omega$

$R_{IN(TOTAL)} = R_1 \parallel R_2 \parallel R_{IN(BASE)}$

$= 47k\Omega \parallel 7.87k\Omega \parallel 53.404k\Omega$

$R_{IN(TOTAL)} = 5.986 k\Omega$

$R_{IN(TOTAL)} = 5.986 k\Omega$

CE AMP STAGE - EXAMPLE #2

VOLTAGE GAIN ; A_V (IDEAL)

$$A_V = \frac{R_C}{r'_e + R_{E_1}} = \frac{2,374\Omega}{10.163\Omega + 295\Omega}$$

$$A_V = 7.78$$

$\boxed{A_V = 7.78}$

$$\text{ATTENUATION} = \frac{R_S + R_{IN(TOTAL)}}{R_{IN(TOTAL)}}$$

$$= \frac{600\Omega + 5.986K\Omega}{5.986K\Omega}$$

$\boxed{\text{ATTENUATION} = 1.10}$

VOLTAGE GAIN (REAL)

$$A'_V = A_V\,(\text{ATTENUATION})^{-1}$$

$$= 7.78\,(1.10)^{-1}$$

$$A'_V = 7.78(0.856)$$

$\boxed{A'_V = 6.65}$

$$V_{OUT} = V_{in} \cdot A'_V$$

$$= 10mV_{rms} \cdot 6.65$$

$\boxed{V_{OUT} = 66.5mV_{rms}}$

(SOURCE CURRENT)

$$I_S = \frac{V_S}{R_S + R_{IN(TOTAL)}} ; \frac{10mV}{600\Omega + 5.986K\Omega}$$

$\boxed{I_S = 1.52mA}$

CURRENT GAIN :

$$A_i = \frac{I_C}{I_S} = \frac{(66.5mV / 2.374K\Omega)}{1.5mA} \quad (R_C)$$

$\boxed{A_i = 18.45}$

POWER GAIN:

$$A_P = A_i\, A'_V$$

$$= (18.45)(6.65)$$

$\boxed{A_P = 122.7}$