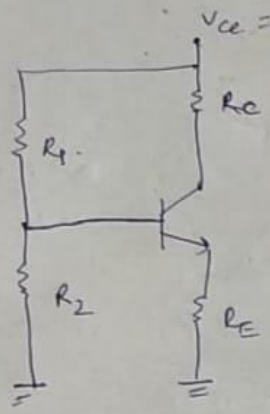
4.

a)

4. (a)



$A_v(oc) = 100$

$I_c = 4\,mA$

$\beta = 100$.

$V_{CE} = 12V$.

Here we have to take value of R_2 such that

$$R_2 \leq \frac{\beta R_E}{10}$$

Hence for this condition $I_B = 0$.

hence $I_c = I_E$.

using KVL

we have

$\Rightarrow V_{cc} - I_c R_c - V_{CE} - I_E R_E = 0$.

$\Rightarrow 24 - I_c R_c - 12 - I_c R_E = 0$.

$\Rightarrow 12 = I_c (R_c + R_E)$

$\Rightarrow \frac{12}{4mA} = R_c + R_E$

$\Rightarrow R_c + R_E = 3\,K\Omega$.

$$A_v(oc) = -100 = -\frac{R_c}{r_e}$$

$$r_e \cong \frac{V_T}{I_c} = \frac{V_T}{I_E} = \frac{25\,mV}{4mA} = \frac{25}{4}\,\Omega.$$

$$R_C = \frac{25}{4} \times 100$$

$$= 625\Omega$$

$$R_E = 3000 - 625$$

$$= 2375\Omega$$

$$\Rightarrow \frac{24}{R_1+R_2} \times R_2 - 0.7 = I_E \times 4mA$$

$$\Rightarrow \frac{R_2}{R_1+R_2} = \frac{7}{40}.$$

Now taking $R_2 = \frac{\beta R_E}{10}$

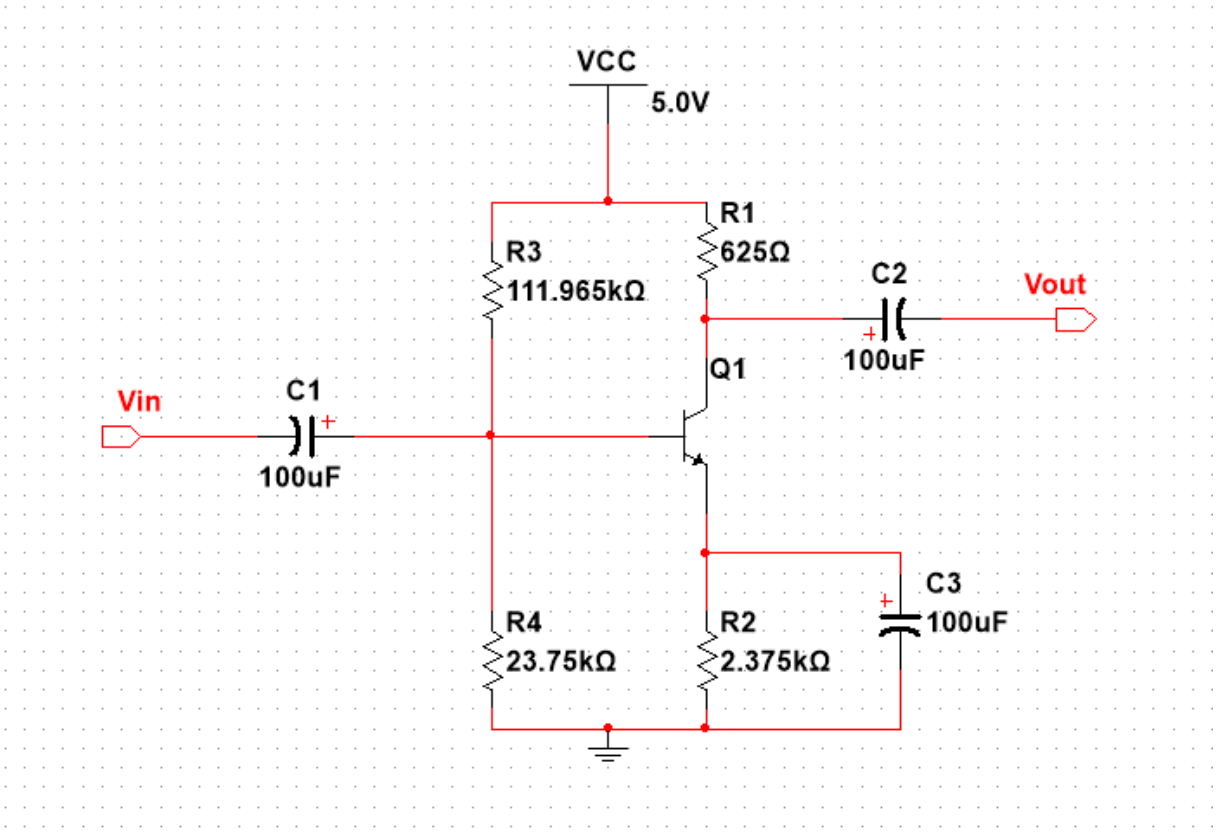
$$= \frac{100 \times 2375}{10}$$

$$= 23750\,\Omega.$$

$$= 23.75k\Omega$$

$$R_1 = \frac{33 \times 23.75k}{7} = 111.965k\Omega.$$

b)



c)

Grapher View

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Design2

DC Operating Point Analysis

	Variable	Operating point value
1	V(vb)	862.07409 m
2	V(vc)	4.95878
3	V(ve)	158.18830 m
4	I(Q1[IB])	659.45728 n
5	I(Q1[IC])	65.94615 u
6	I(Q1[IE])	-66.60560 u
7	I(Q1[IS])	0.00000e+00

Selected Page:DC Operating Point

d)

(d) In DC operation the capacitors are open circuited because we know the frequency of supply in DC is zero

$X_C = \frac{1}{j\omega C}$ so $X_C = \infty$

Here it is replaced with an open circuit.

e)

(e) The resistance R_i is the equivalent resistance between base and ground for the transistor with an emitter resistor R_E that the reflected resistance between base and emitter is defined by $R_i = (\beta+1) R_E$

If R_i is much larger than the resistance R_2, the current I_B will be much smaller than I_2 so I_B is essentially $= 0$.

so $R_i \approx \beta R_E$ the approximation can be done.

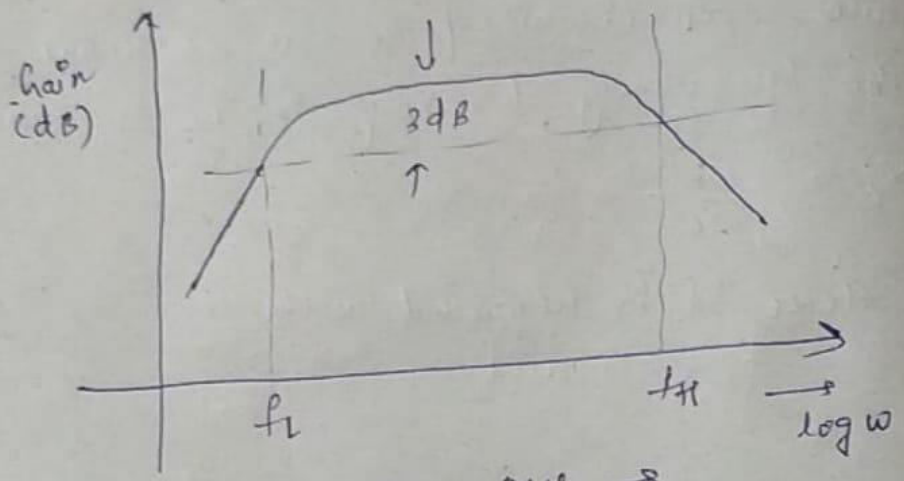
$R R_E \geq 10 R_2$

f)

(f) since from the above result EB Junction is +ve hence forward bias and V_{CB} is -ve so reverse bias hence it operate on active region.

g)

(g)



← Bandwidth →.

Low frequency.

→ At low frequency the gain reduces because of coupling capacitor which causes voltage drop

→ bypass capacitors which didn't completely bypass the source resistance or ammeter resistance causing -ve feedback.

Heigh frequency

→ It was due to internal or parasitic capacitances Now in BJT these capacitors include the capacitance between gate and source.