

***Faculty of Engineering and Technology***

***Electrical and Computer Engineering Department***

***Electronic lab (ENEE3102)***

**Pre lab of EX #6**

 **Multistage Amplifiers and Frequency Response " "**

**Instructor :-**

**Dr. Mohammad Jehad Ju'Beh**

**ENG . Amjad Shaalan**

**Prebared by :- Hussam Ali**

**ID:- 1172476**

**Sec:-1**

 ***I. Multistage Amplifier Design:***

We want to design a two-stage amplifier with a voltage gain 200 to give a peak-to-peak output of 2.5 v.

Av1 = 100, Av2 = 2, Vi = 12.5 m Vp-p .

To design the first stage of the amplifier for the h-parameters of a transistor are

hie = 4\*$10^{3}$Ω

 hoe = $10^{-4}$ 1\Ω

 hfe = 300

 hre = 10-3

Vcc = 10v

The capacitor = 100uF in parallel with $R\_{E}$.

* design the first stage:(before not found values of resistors)



 Dc analysis



$ h\_{fe=β=300}$=

$$hie=\frac{vT}{IB}=\frac{25.6mv}{IB}=4\*10^{3} \rightarrow IB=6.4\*10^{-6} A$$

IE=(hfe+1)IB =(300+1)6.4\*$10^{-6}=1.92\*10^{-3}A$

Ic=$ β ib=300\*6.4\*10^{-6}=1.92\*10^{-3}A$

IC=IE

Let VE=0.1 vcc VE=0.1\*10=1V

$V\_{\begin{array}{c}E \rightarrow RE=519Ω\\ \end{array}}$ $I\_{E}$ $R\_{E}$=

To Find $R\_{1}$ & $R\_{2}$ we need to $R\_{TH}$ & $V\_{TH}$

$$RTH=\frac{R2}{R2 R1}VCC=\frac{β RE}{10}=\frac{300\*519}{10}=15570Ω=15..6KΩ$$

VTH+VBE+RE\*IE+(RTH\$ (β+1)$ \*IE)=0-

$ V\_{TH}$= $I\_{E}[$ $\frac{R\_{TH}}{β+1}$ + $R\_{E}$ ] + $V\_{BE}=$

$V\_{TH}$ = 1.926 [$ \frac{15.57 }{301}$ + 0.519 ] + 0.7

$V\_{TH}$ = 1.8 volt.

$V\_{TH}$ = $\frac{R\_{2}}{R\_{1+ R\_{2}}}$ $V\_{CC} $ $\rightarrow $ $\frac{V\_{TH}}{V\_{CC}}$ = $\frac{R\_{2}}{R\_{1+ R\_{2}}}$ $ $

$\frac{R\_{2}}{R\_{1}+ R\_{2} }$ $ $= 0.18 $\leftrightarrow (1)$

$R\_{TH}$ = $\frac{R\_{1}R\_{2}}{R\_{1}+ R\_{2}}$ = 15.57 $\leftrightarrow (2)$

We make up (1) in (2) and we get:

 $R\_{1}$ = 86.5 K$Ω$

$R\_{2}$ = 18.98 K$Ω$

 Ac analysis (small signal equivalent circuit):



Find RC ??

$V\_{O }$= - $h\_{fe}$\*$i\_{b}$\* ($R\_{C} $//$\frac{1}{h\_{oe}}$).

$i\_{b}$ =$ \frac{V\_{i }}{h\_{ie}}$

$V\_{O }$= = - $h\_{fe}$\*$ \frac{ V\_{i }}{h\_{ie}} $\* ($R\_{C} $//$\frac{1}{h\_{oe}}$).

$\frac{V\_{O }}{V\_{i }}$= - $h\_{fe}$\* $\frac{ 1}{h\_{ie}} $\* ($R\_{C} $//$\frac{1}{h\_{oe}}$) = 100

-300 \*$\frac{1}{4000}$ \*$ R\_{C} $//$\frac{1}{10^{4}}$ = - 100

$ R\_{C} $//$\frac{1}{10^{4}}$ = 1333.33

($ R\_{C}$\*$10^{4}$)/( $R\_{C}$+$10^{4})$ = 1333.33

$ R\_{C} $= 1.538 k$Ω$



Then the same procedure for stage 2:

The values of R1,R3,RE are the same of stage 1 but Rc is different because the gain is 2:

$V\_{O }$= - $h\_{fe}$\*$i\_{b}$\* ($R\_{C} $//$\frac{1}{h\_{oe}}$).

$i\_{b}$ =$ \frac{V\_{i }}{h\_{ie}}$

$V\_{O }$= = - $h\_{fe}$\*$ \frac{ V\_{i }}{h\_{ie}} $\* ($R\_{C} $//$\frac{1}{h\_{oe}}$).

$\frac{V\_{O }}{V\_{i }}$= - $h\_{fe}$\* $\frac{ 1}{h\_{ie}} $\* ($R\_{C} $//$\frac{1}{h\_{oe}}$) = 2

-300 \*$\frac{1}{4000}$ \*$ R\_{C} $//$\frac{1}{10^{4}}$ = - 2

$ R\_{C} $//$\frac{1}{10^{4}}$ = 26.67

($ R\_{C}$\*$10^{4}$)/( $R\_{C}$+$10^{4})$ = 26.67

$ R\_{C} $= 26.74 k$Ω$

When we setup the designed for stage 2 circuit, the voltages are :



 **The two stages together ::**

 

 **Vin show in figure below :**

****

**Vout show in figure below :**

****

 $Voltage gain $**show in figure below :**

****

**III. DIFFERENTIAL AMPLIFIER**.

1)a

***II. FREQUENCY RESPONSE.***

In lab taken and fill the table data in different frequency