Faculty of Engineering and Technology
Department of Electrical and Computer Engineering

ENEE 2103

CIRCUITS AND ELECTRONICS LABORATORY

Experiment #7, Pre-Lab #3

" BJT Transistor As An Amplifier, CE, CC, CB Connection"

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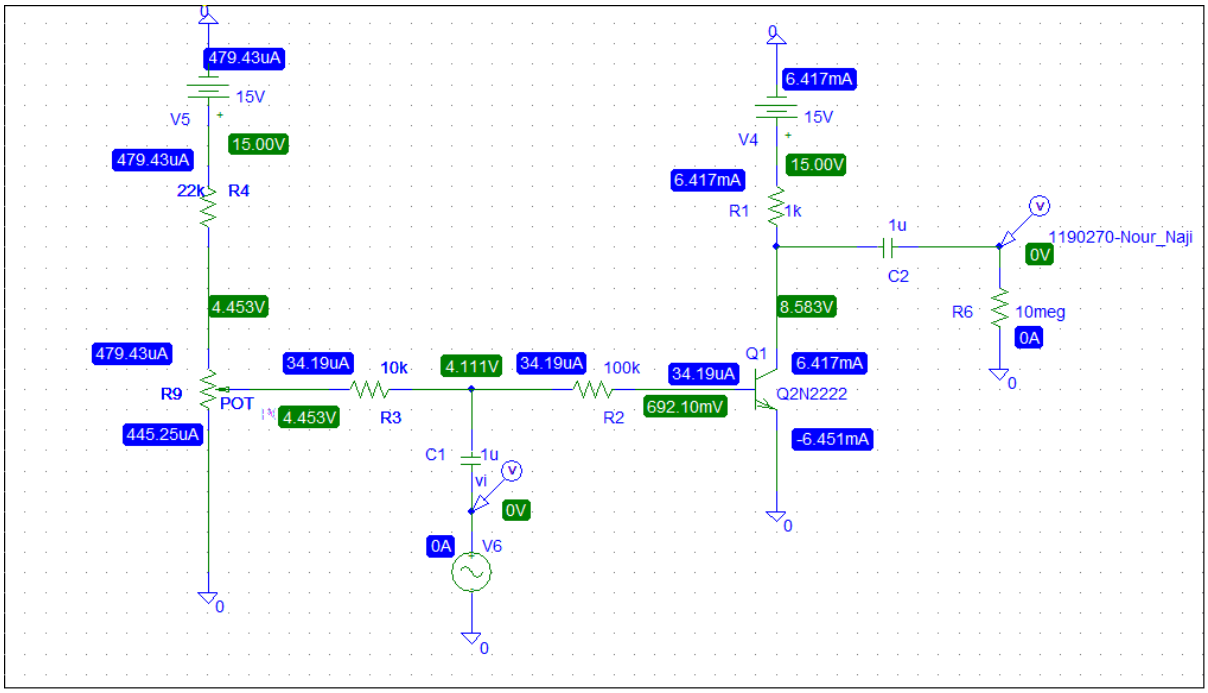


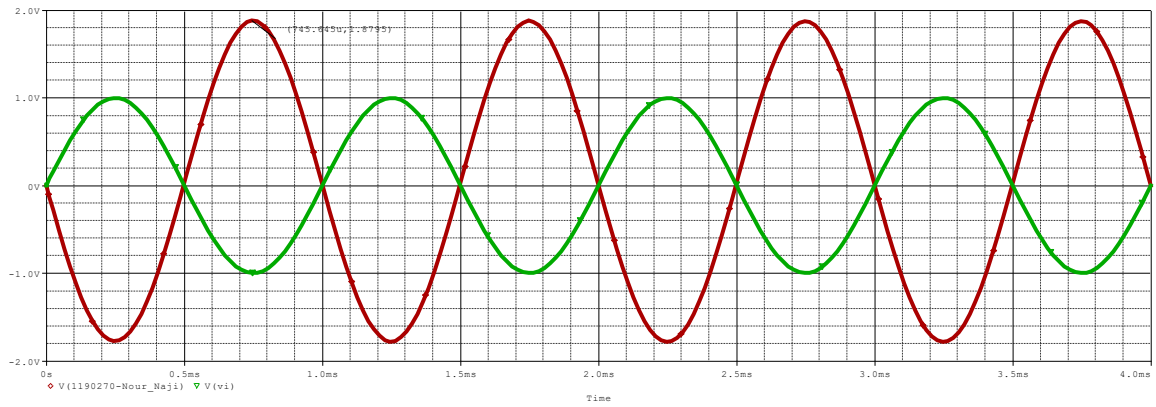
Figure 1-1:COMMON EMITTER TRANSISTOR AMPLIFIER

❖ Dc values:

- $V_C = 8.583$ v
- $V_{BE} = 692.10$ mv
- $V_{CE} = V_C - V_E = 8.583 - 0 = 8.583$v
- $I_C = 6.417$ mA
- $I_B = 34.19$ mA

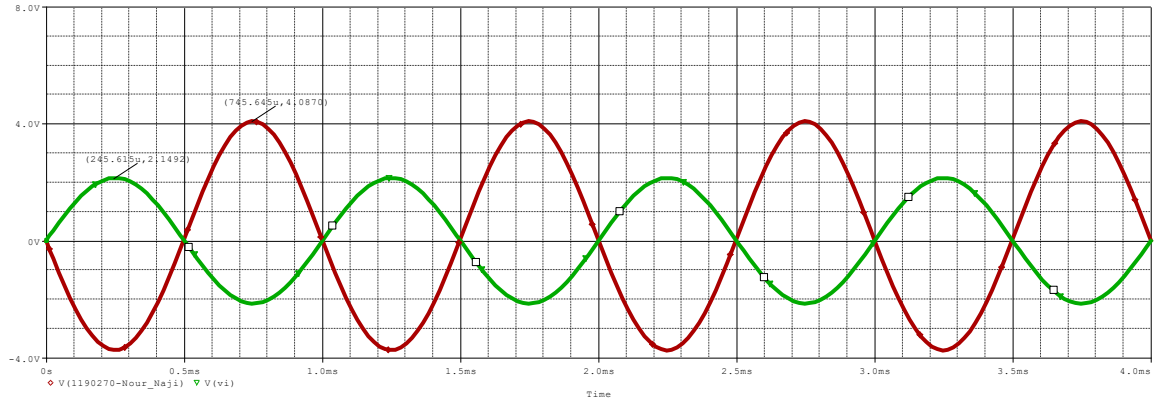
❖ Adjust amplitude of Vi(t) to 1 V and measure $V_O(t)$

Peak value of $V_O(t)$ = 1.8795 v

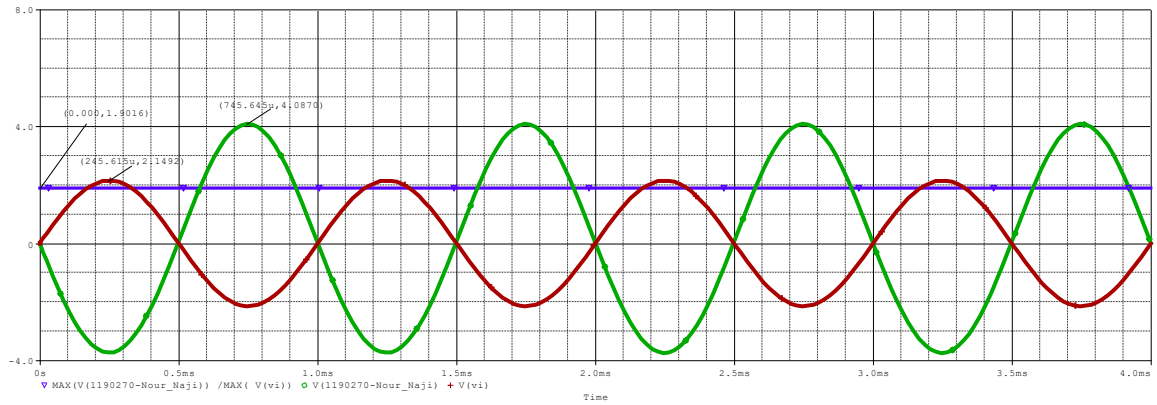


❖ Change peak of Vi(t) such that $V_O(t)$ =4V peak and perform Transient analysis.

- Peak value of Vi(t) = 2.1492 v.

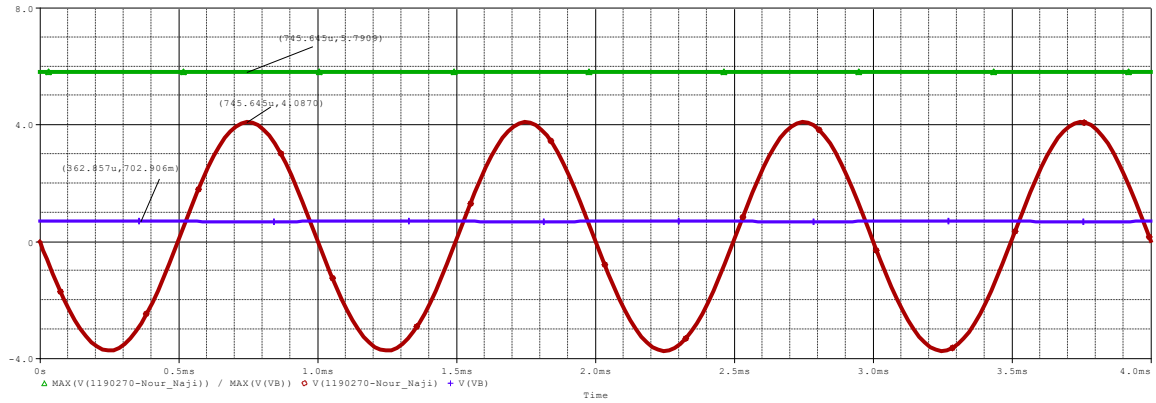


❖ Calculate the voltage gain of the transistor Av $= \frac{vo(t)}{vi(t)}$



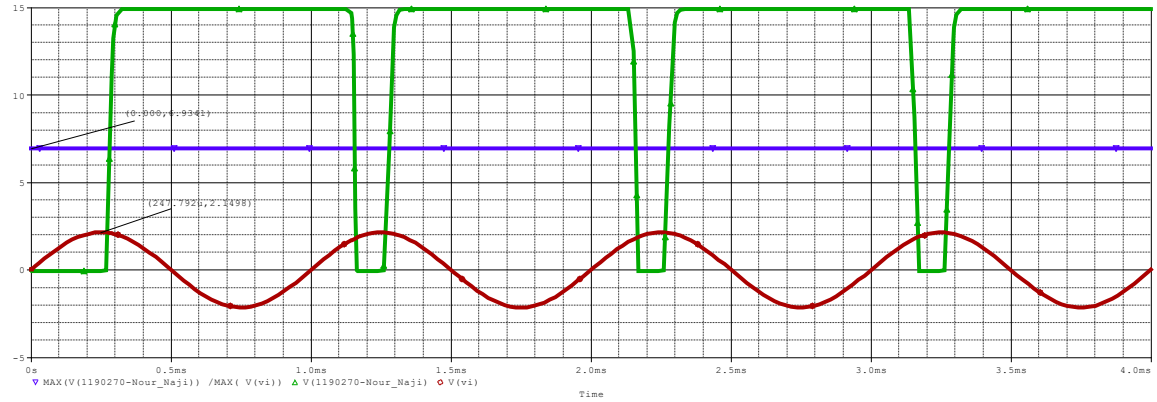
- Av (experimentally) $= \frac{vo(t)}{vi(t)} = 1.9$
- Av (theoretically) $= \frac{vo(t)}{vi(t)} = \frac{4}{2.15} = 1.86$

❖ Calculate the voltage gain of the transistor Av1 $= \frac{vo(t)}{v\mathrm{B(t)}}$



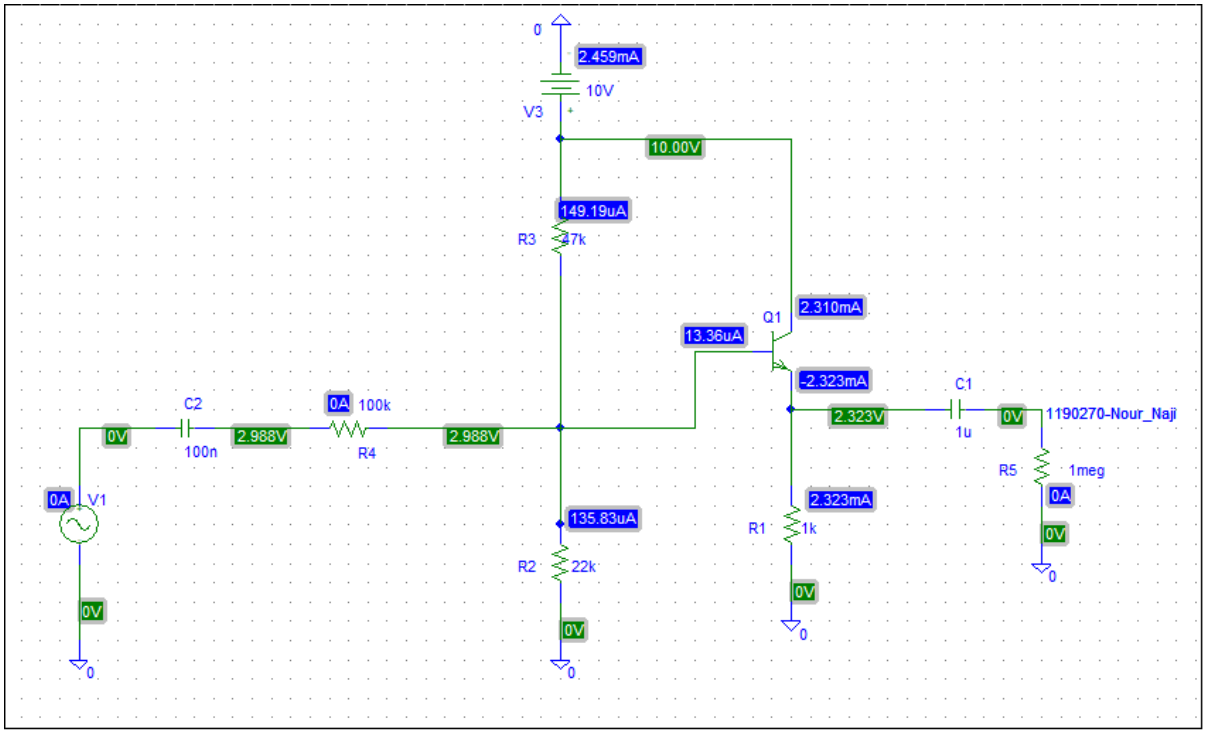
- Av (experimentally) $= \frac{vo(t)}{v\mathrm{B(t)}} = 5.7909$
- Av (theoretically) $= \frac{vo(t)}{v\mathrm{B(t)}} = \frac{4}{692.10\ \mathrm{mv}} = 5.779$

❖ Remove the 100k resistor and see what happens to voltage gain?



✓ We can see from the figure above that the voltage gain will increase dramatically
⇨ $A_V = 6.9341$

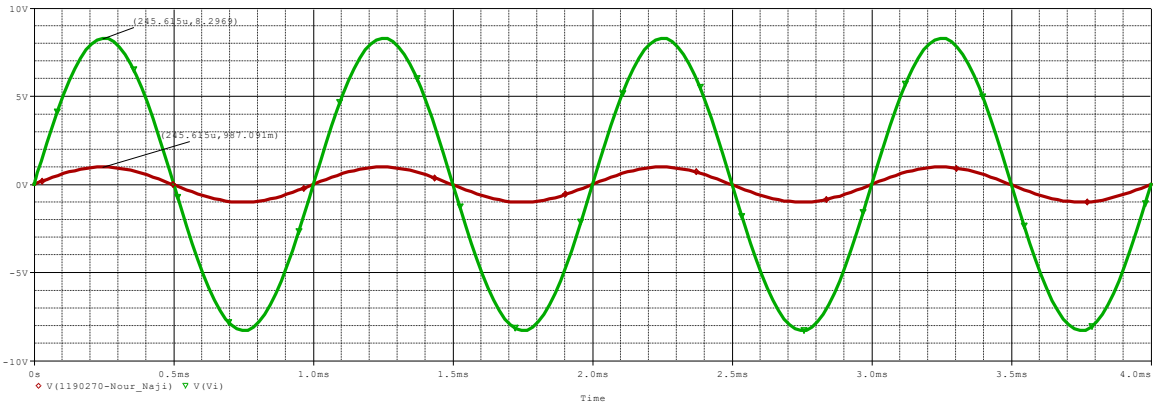
2. COMMON COLLECTER TRANSISTOR AMPLIFIER)



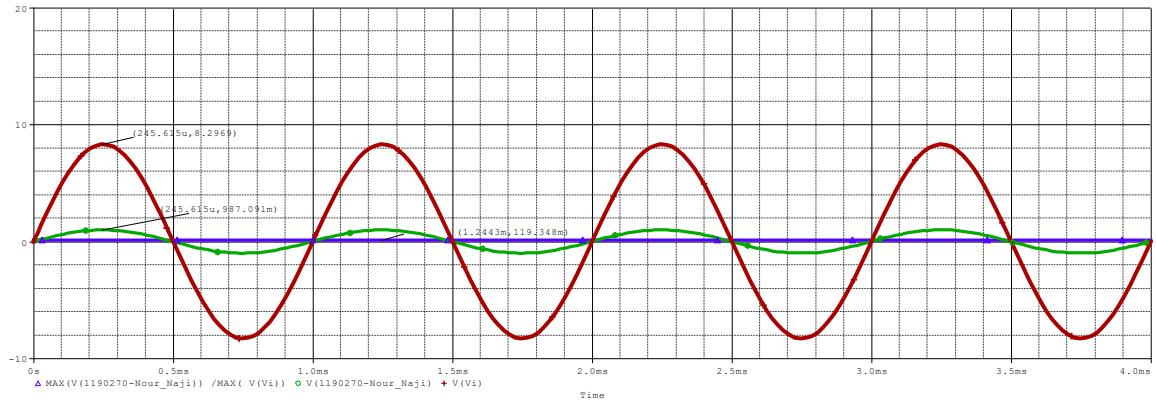
- Dc values:
  - $V_B = 2.988$ v
  - $V_C = 10$ v
  - $I_B = 13.36$ µA
  - $I_C = 2.310$ mA

- Adjust the amplitude of the sine wave generator until an output amplitude from the amplifier is about 2 volts peak-to-peak. (Make sure the waveform is undistorted).

  - Amplitude of Vi(t) = 8.3v

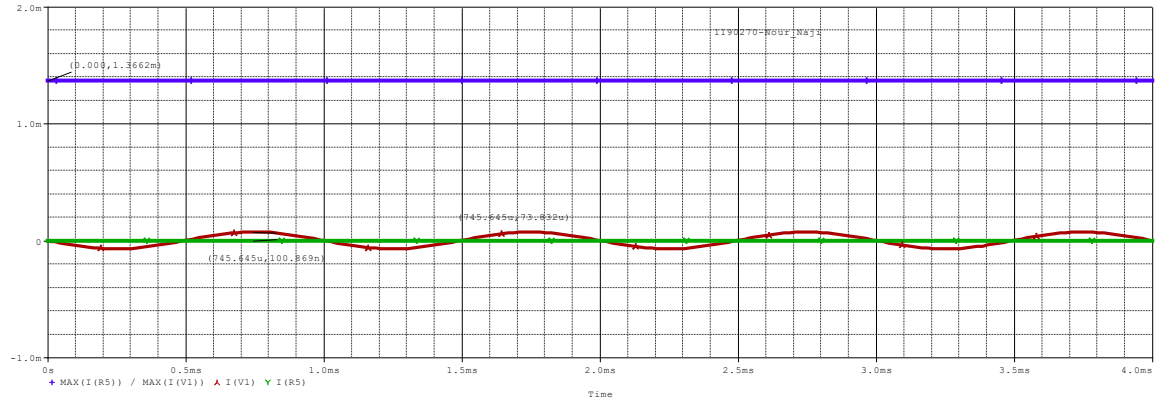


❖ Calculate the voltage gain Av



- $\text{Av} = \frac{vo(t)}{vi(t)} = 0.119348$

❖ Measure the input and output currents and calculate Ai

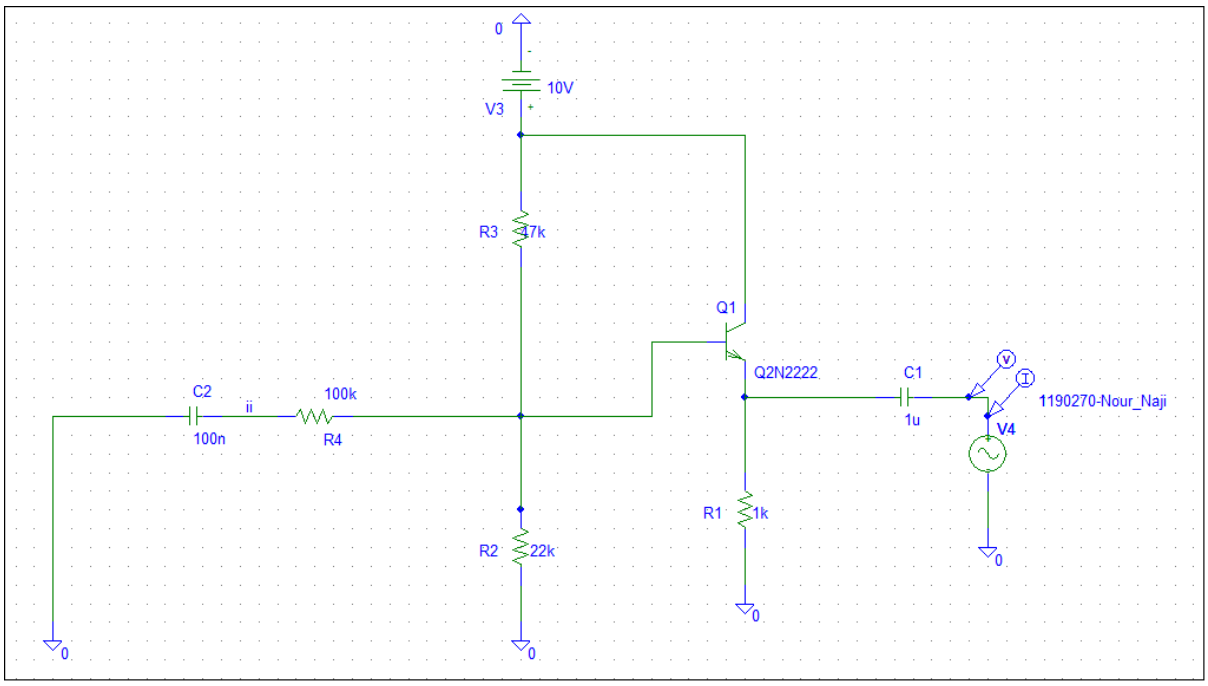


- $\text{Ai} = \frac{Io(t)}{Ii(t)} = \frac{100.869n}{73.832u} = 1.3662m$

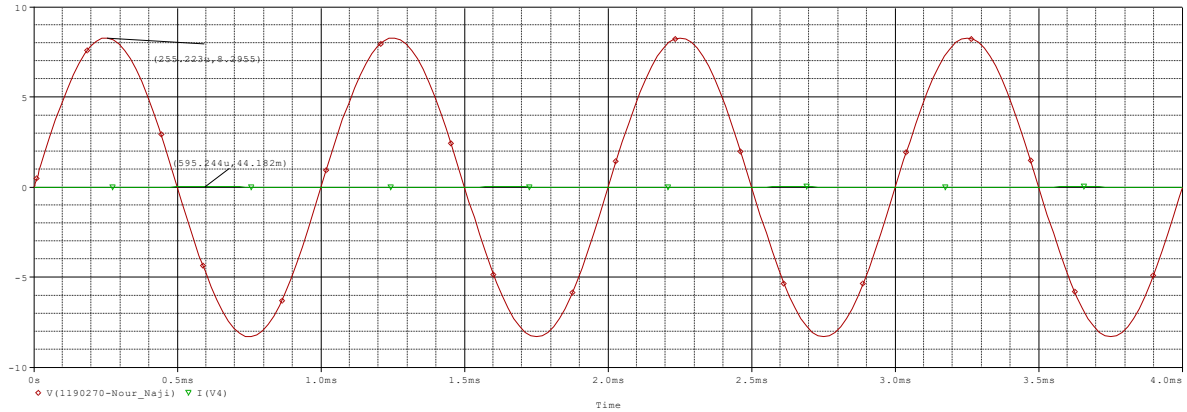
❖ Estimate Zi from Ii and Vi values

- $\text{Zi} = \frac{\text{Vi}}{\text{Ii}} = \frac{8.3}{73.832\ \text{u}} = 112417.38\ \Omega$

- To find the output impedance of the amplifier, you should take off the input sine wave generator and replace it with a short circuit, then you have to connect the generator to the output (emitter) via a capacitor, and measure its output voltage and current.



- Iout &Vout



- $\text{Zout} = \frac{\text{Vout}}{\text{Iout}} = \frac{8.2955}{44.182\text{m}} = 187.757\Omega$

QUANTITY	MEASURED VALUES
V_{IN}	8.3 v
V_{OUT}	987.091
I_{IN}	$73.832u$
I_{OUT}	$100.869n$
	Calculated values
$A_V=V_{OUT}/V_{IN}$	0.119348
$A_I=I_{OUT}/I_{IN}$	$1.3662m$
$Z_{IN}=V_{IN}/I_{IN}$	112417.38 Ω
Z_{OUT}	187.757Ω