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Activity #6b: Common Base, Common Emitter, Common Collector Circuit

ECE101-1L – FUNDAMENTALS OF ELECTRONIC CIRCUITS (LAB)

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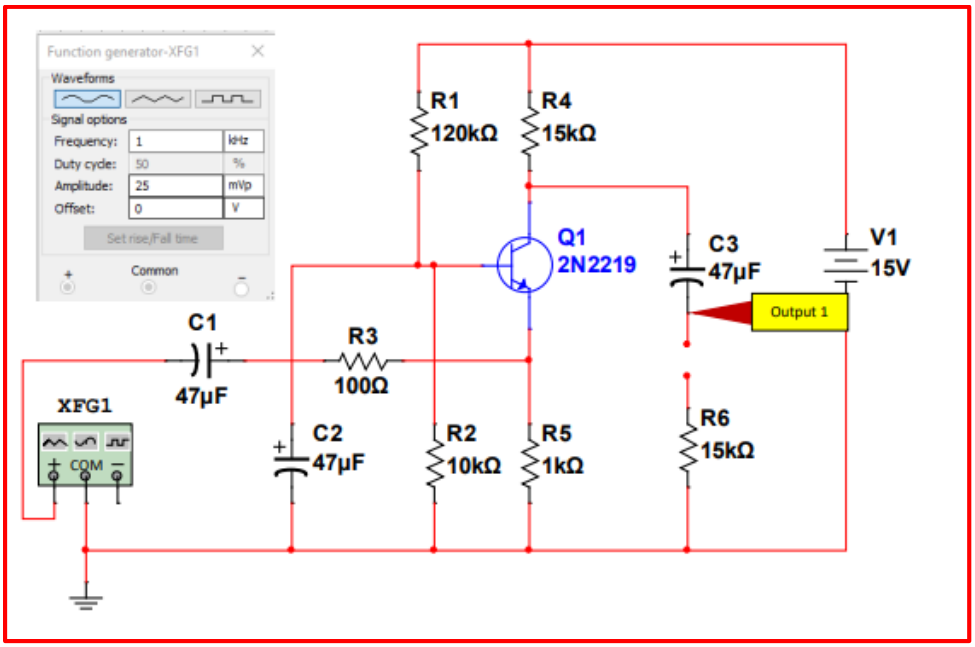
Part A. Common Base

1. Using Multisim create the schematic shown below, and change the function generator settings as shown below.



2. Measure and Record the DC Voltages

VC	7.379V
VB	1.118V
VE	511.937mV

3. Is the transistor properly biased for AC Operation?

Yes, there's a low input impedance on the base and emitter and the collector has high output impedance

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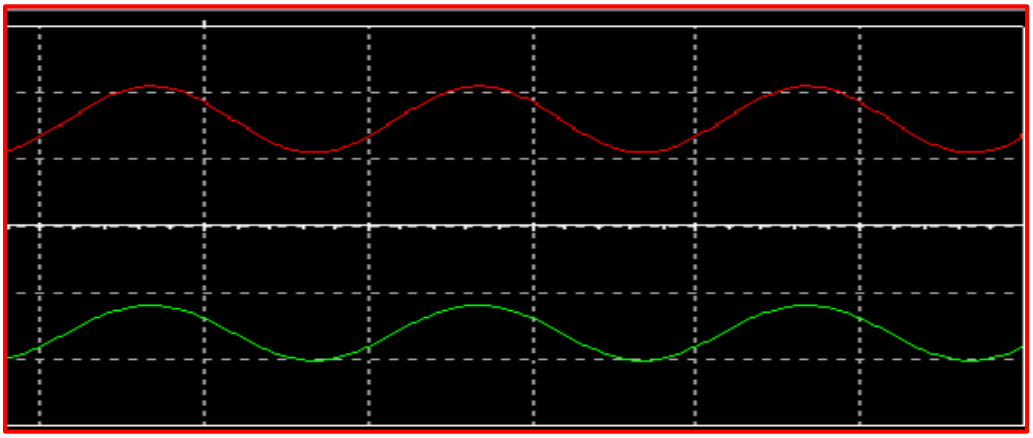
4. Place an Oscilloscope and Probe Channel 1 to the Input Signal and Channel 2 to the Output of the Transistor, change the color of each waveform, change the vertical placement of each waveform and screenshot the Input and Output waveform



5. What is the peak-to-peak voltage of output signal?

4.136 V

6. Is there any distortion?

No distortion

7. What is the phase relationship between the output and Input signals?

output and input is 0 degrees , no phase change could be observed.

8. Calculate and record the voltage gain (Av = Vo/Vi) (Note: Use peak-to-peak voltage measurements instead of rms values)

83.1774761187 V

9. Connect resistor R6 to C3 at the collector terminal. The collector terminal output impedance is now the parallel resistance of R6 and the original collector output impedance. What is the new peak-to-peak Voltage (Vo) of the output signal? (Note: When the output voltage is decreased by 50% the original output impedance equals the resistance of R6, which was connected in parallel with R4.)

2.47 V

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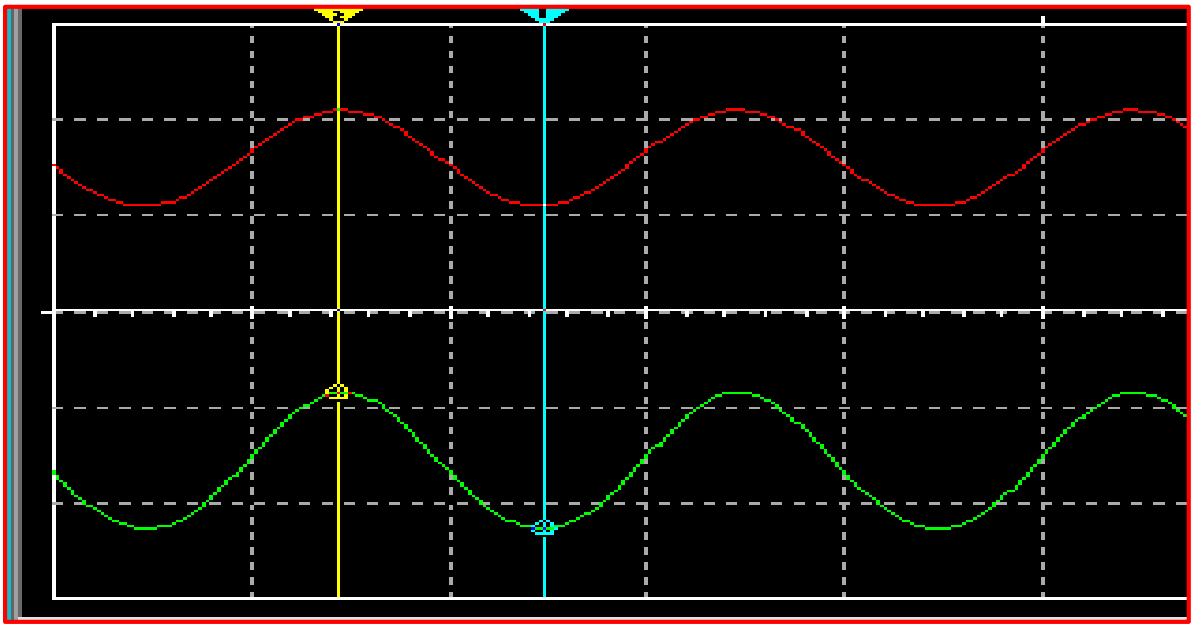
10. Based on the decrease in the output voltage, what was the original output impedance?

TBA

11. Change the R1 Value to 10Kohms. Did the output signal decrease or increase? Screenshot the output waveform.



12. Measure and record the new DC Voltages of transistor.

VC	1.88V
VB	2.531V
VE	1.869V

13. Base from the values measured above, does the transistor operate in Active region?

Yes, VCE is reverse bias, VBE is forward bias.

Part B. Common Emitter

1. Using Multisim create the schematic shown below and change the function generator settings as shown below.

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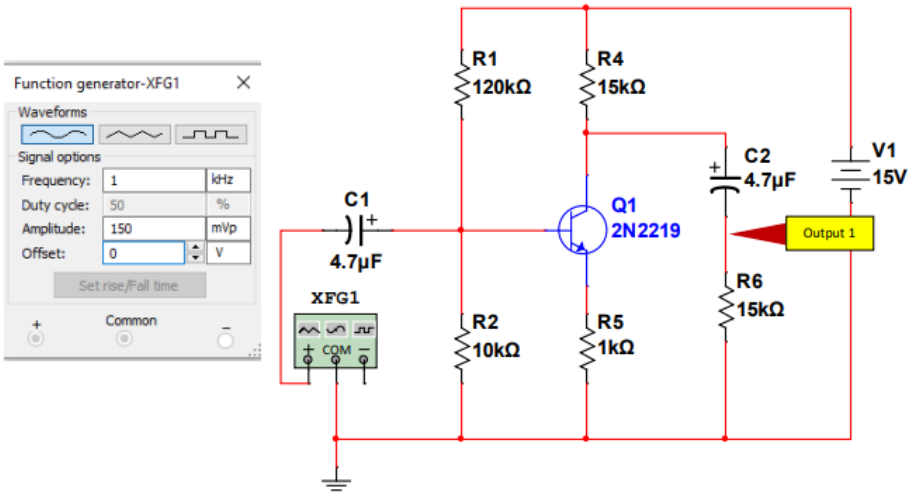

2. Measure and record the new DC Voltages of transistor

VC	512.394 mV
VB	1.119 V
VE	7.371 V

3. Is the NPN transistor Q1 properly biased for ac operation? Why?

4. Place an Oscilloscope and probe CH1 to the output of function generator and probe CH2 to the output of the Transistor Circuit. Adjust the Colors and Position of each waveform.

a. Screenshot the output of oscilloscope showing 2 waveforms.

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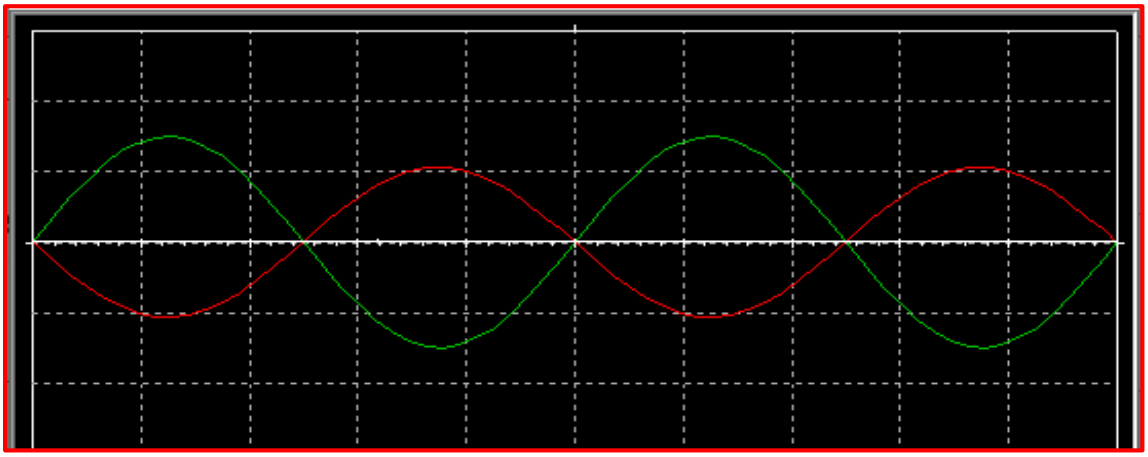

b. What is the peak-to-peak voltage of the Output signal?

c. Is there any distortion or clipping of the sinewave between input and output?

Yes

d. What is the phase relationship between output and input signals?

5. Calculate and Record the Voltage Gain (Av = -Vo/Vi)

(Note: Use the peak-to-peak values instead of rms)

6. Calculate and Record the Voltage gain using (Av = -ri/R5)

(Note: ri is the parallel resistance of R4 and R6)

7. Is the Result in #5 and #6 same or almost same?

8. The Q-point on the load line is at intersection of IC and VCE. Using the voltage measurements in Part B. #2, Calculate the following

a. Collector Current Ic = (V1-VC)/R4

b. Collector-Emitter Voltage VCE = VC-VE

c. Saturation Current ICsat = Ic + [VCE/(ri+R5)]

9. You can use any spreadsheet software (ex. Excel). Plot the following:

a. Qpoint (Intersection of IC and VCE)

b. ICsat

c. VCE (Cutoff)

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Part C. Common Collector

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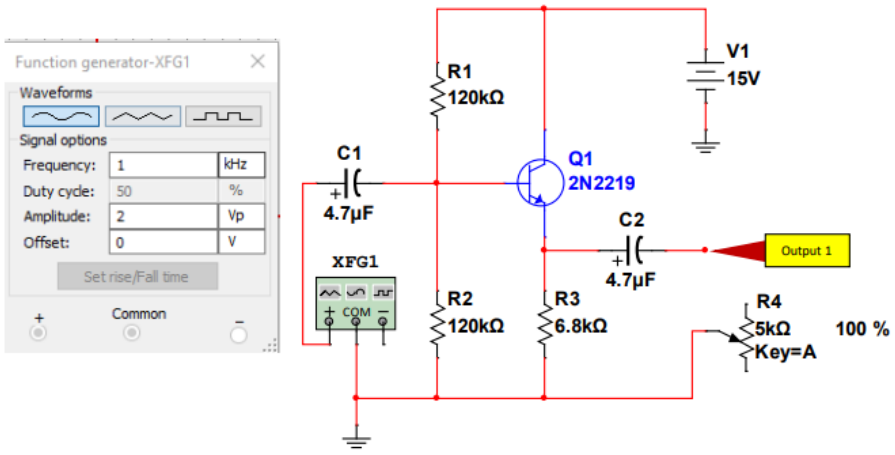

2. Measure and record the new DC Voltages of transistor

VC	15V
VB	7.14V
VE	6.52

3. Is the NPN transistor Q1 properly biased for ac operation? Why?

Yes, NPN Transistor is properly biased for AC operation. Because they all have high voltage reading that means high conductivity.

4. Place an Oscilloscope and probe CH1 to the output of function generator and probe CH2 to the output of the Transistor Circuit. Adjust the Colors and Position of each waveform.

a. Screenshot the Output of the oscilloscope showing the 2 waveforms

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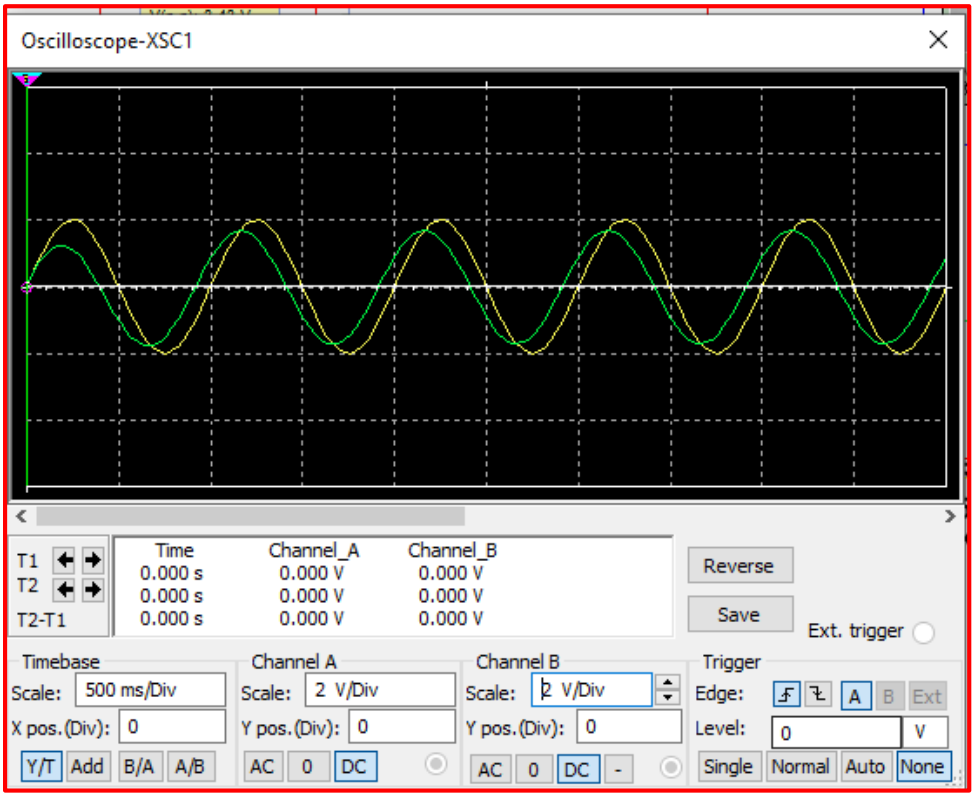

b. What is the peak-to-peak voltage of the Output signal?

3.4V

c. Is there any distortion or clipping of the sinewave between input and output?

No, there are no distortions or clipping of the sinewave between the input and output

5. Calculate and record the voltage gain (Av = Vo/Vi).

(Vout p-p)/(Vin p-p)=3.4v/2v= 1.7V/V

6. Connect the terminal of capacitor and the potentiometer R4 and set the R4 to 90%

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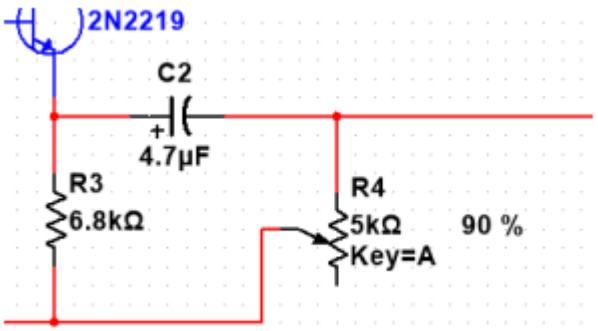
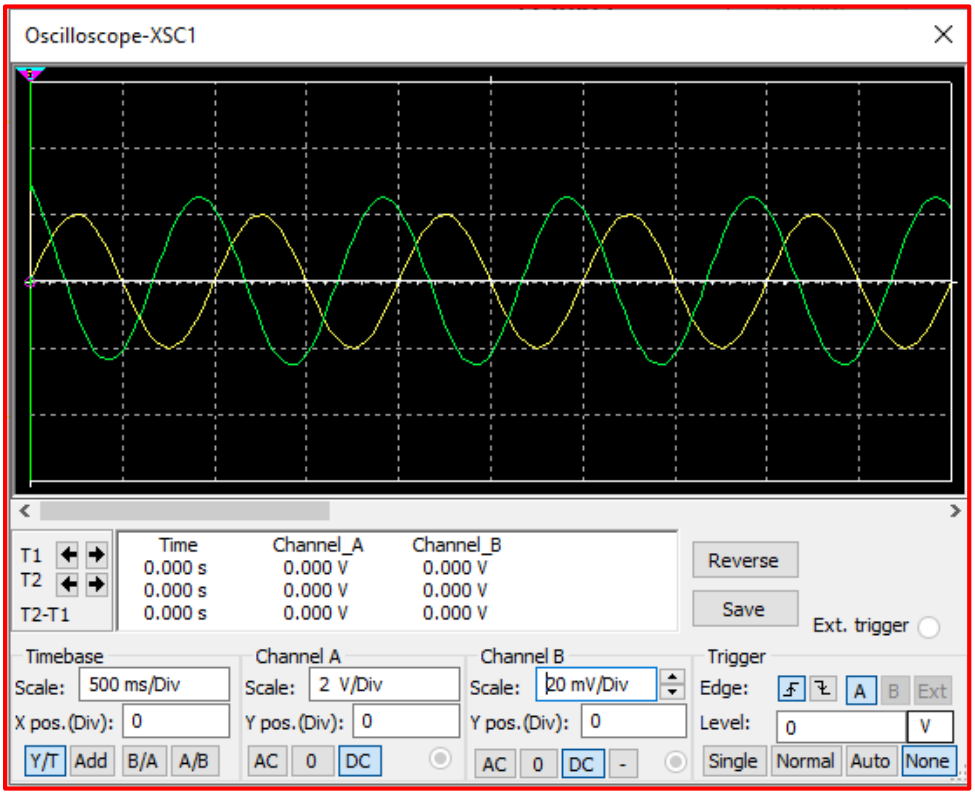


7. Screenshot the output of Oscilloscope shown 2 waveforms (Input and Output).



8. Is there any distortion on the Output Signal?

There are no distortions on the output signal.