Electronics Lab
Lab Session 3: BJT Characteristics and DC Biasing

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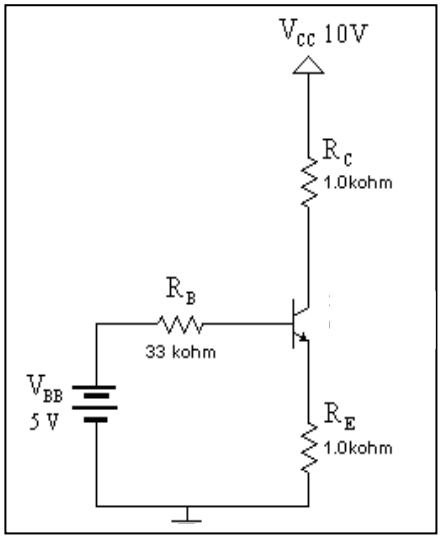
Part 1: Determining Transistor Parameters and the DC Load Line

1. Connect the circuit as shown in Figure 8 in the lab manual using NPN transistor and fill the following table:

Parameter	Measured
V_C	6.4670v
V_B	4.254v
V_E	3.555v
V_{CEQ}	2.912v
V_{BEQ}	0.698v
I_{BQ}	0.022mA
I_{EQ}	3.555mA
ICQ	3.533mA
β	160.59
α	0.9938

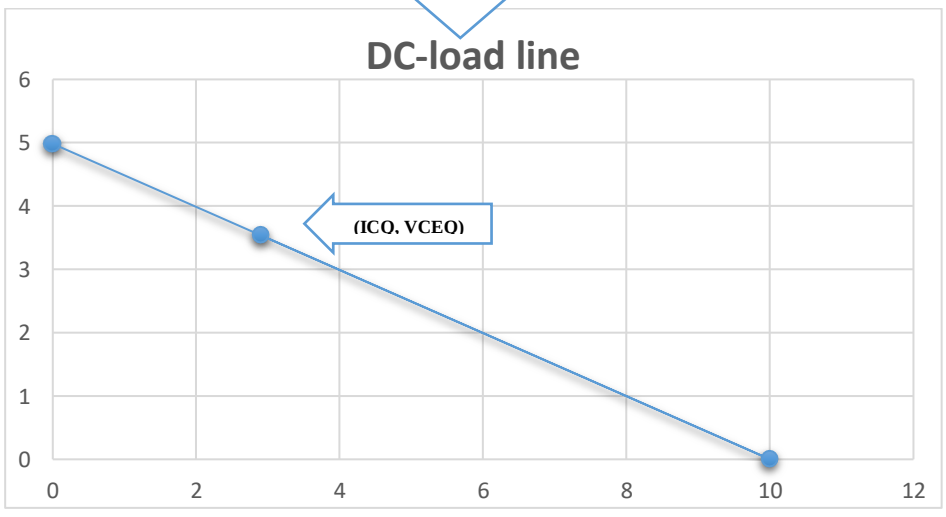


3. Determine the saturation ($I_{C(short)}$) and cutoff ($V_{CE(off)}$) points on the DC load line for this circuit, then plot the DC load line. Locate the Q point based on the measured values of I_{CQ} and V_{CEQ} .

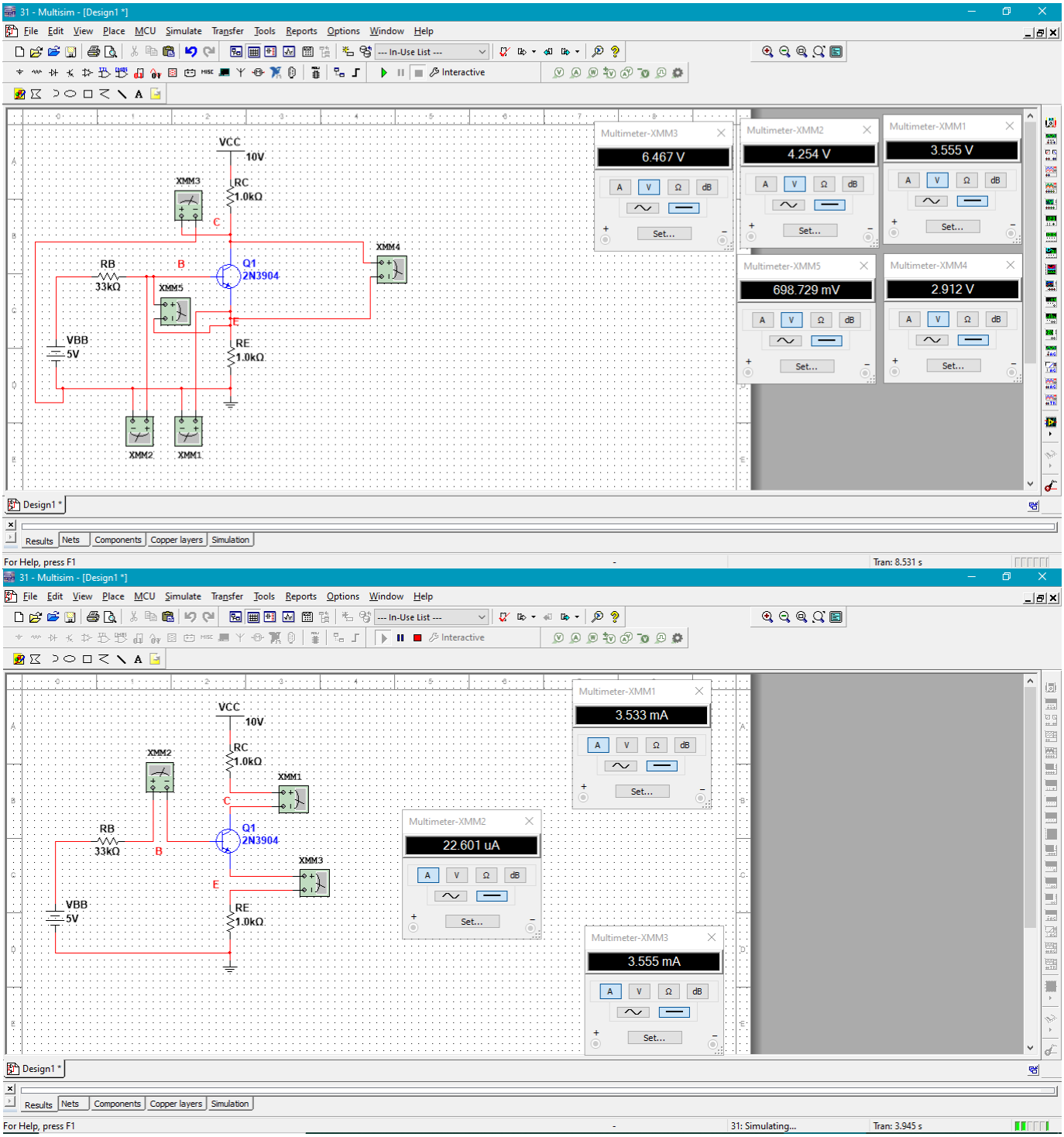
By KVL the DC-load line equ is:

$$IC = \frac{10-Vce}{1+\frac{\beta+1}{\beta}}$$

so when Ic =0 mA ,Vce = 10 V
when Vce = 0 ,V Ic =4.983 mA



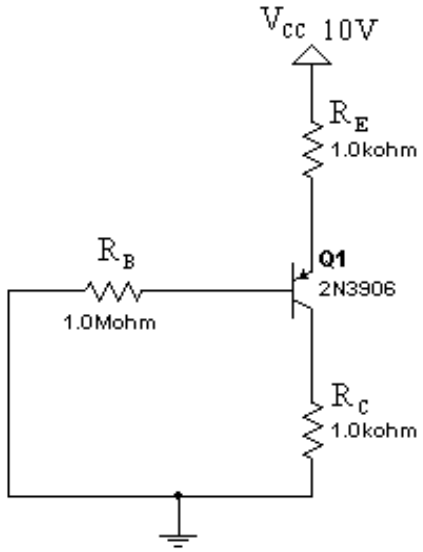
MULTISIM RESULTS FOR PART 1



PART2

4. Connect the circuit as shown in Figure 9 in the lab manual using PNP transistor and fill the following table:

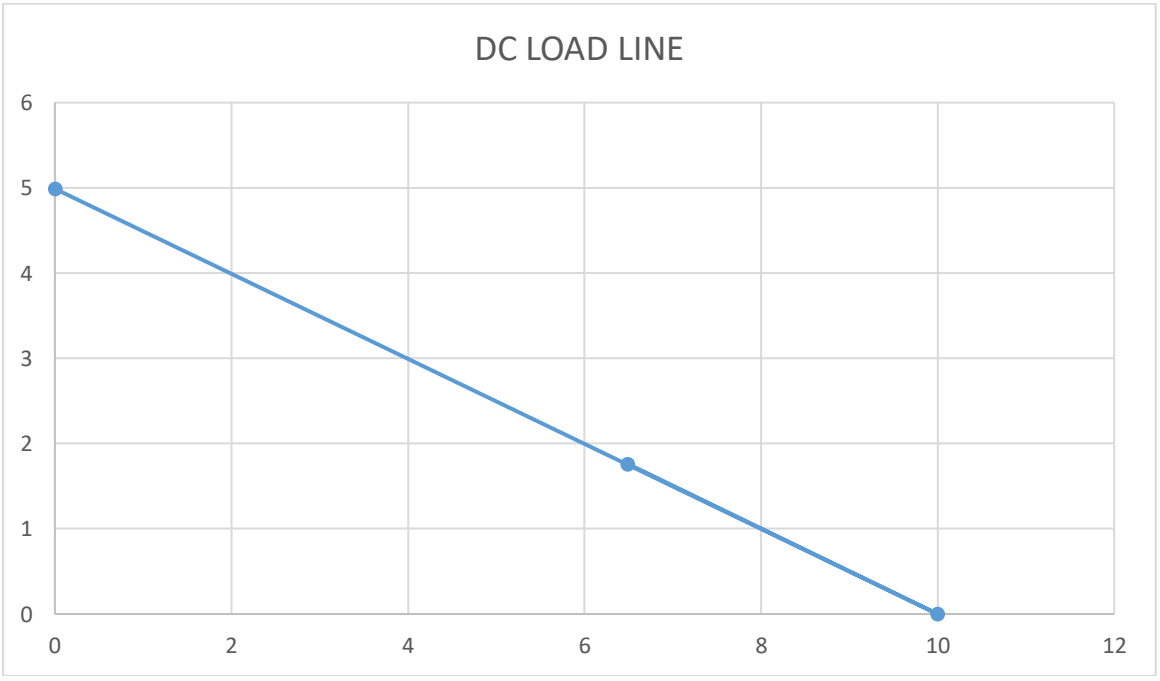
Parameter	Measured
V_C	1.752v
V_B	7.527v
V_E	8.24v
V_{ECQ}	6.488v
V_{EBQ}	0.713v
I_{CQ}	1.751mA
I_{BQ}	0.007528mA
I_{EQ}	1.758mA
β	232.59
α	0.9957



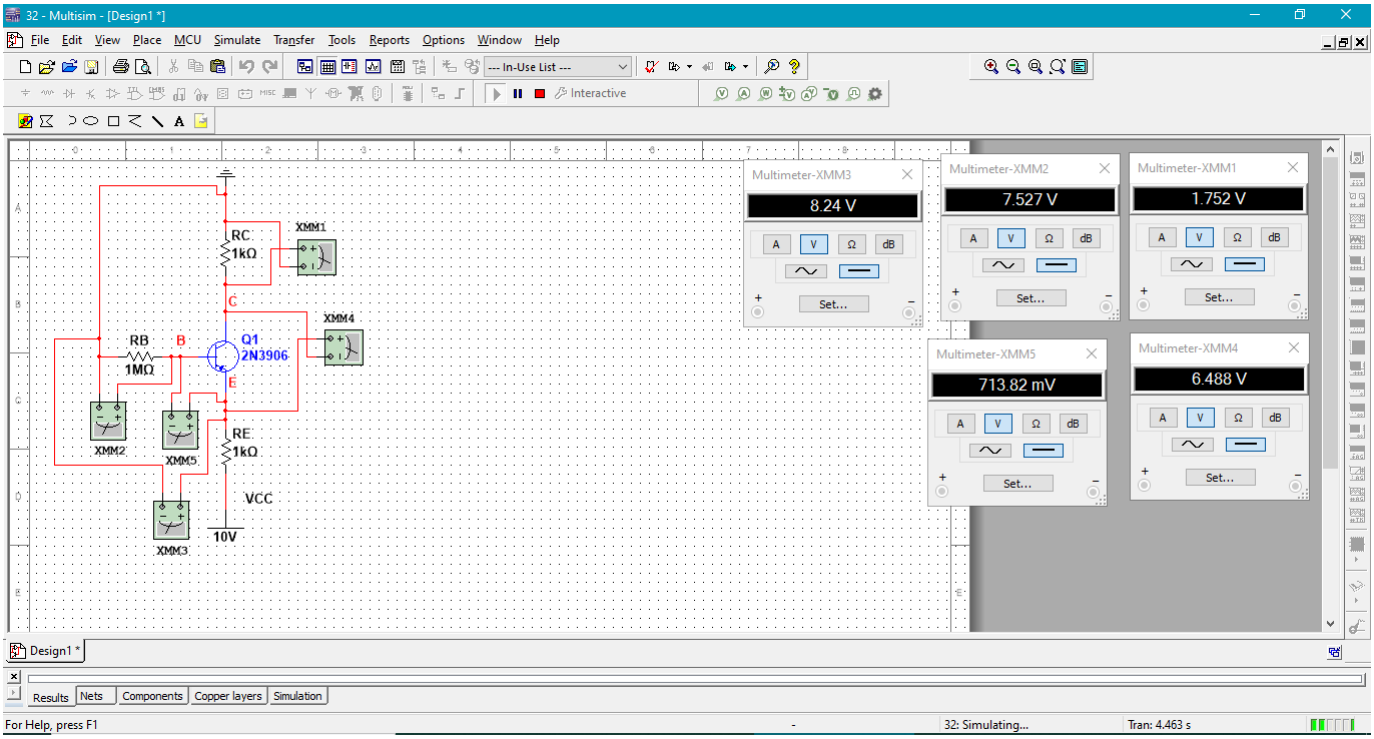
5. Determine the saturation ($I_{C(short)}$) and cutoff ($V_{CE(off)}$) points on the DC load line for this circuit, then plot the DC load line ne. Locate the Q point based on the measured values of I_{CQ} and V_{CEQ} .

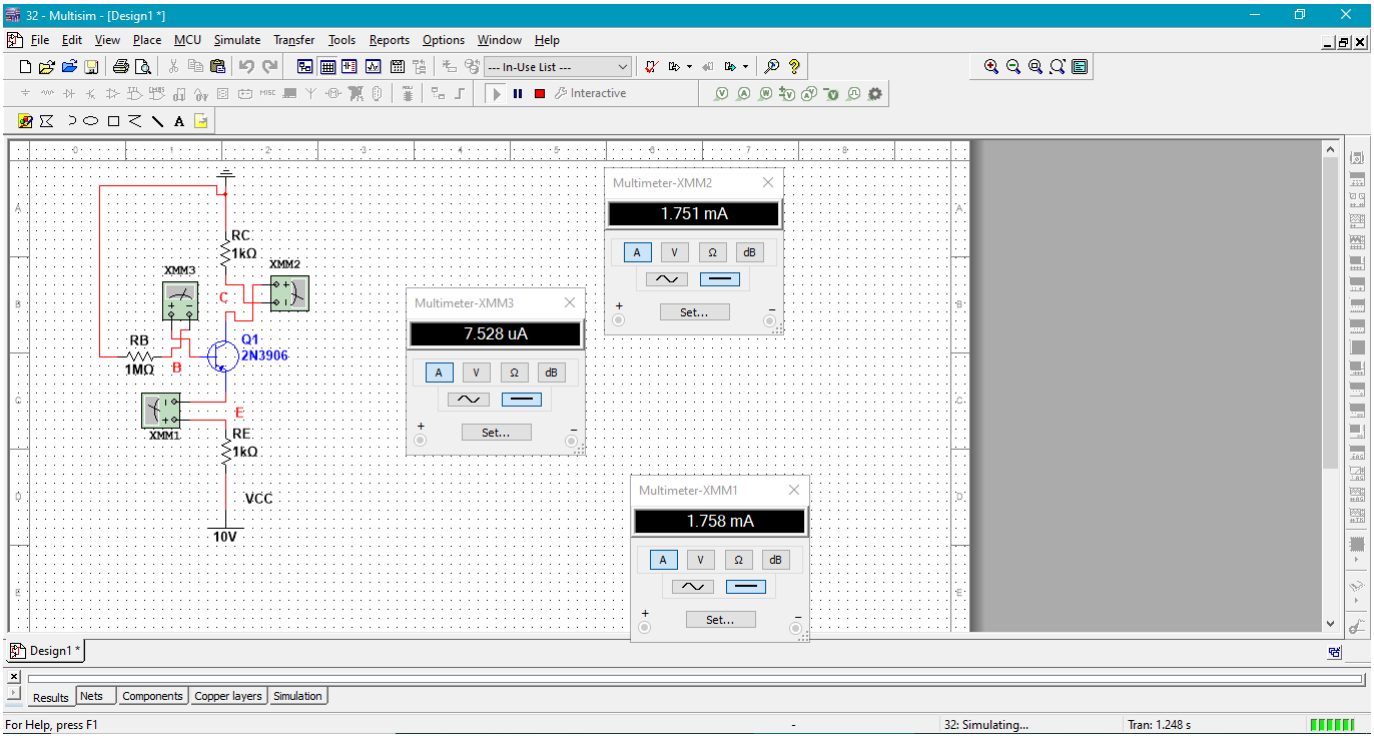
$$IC = \frac{10-VEC}{1+\frac{\beta+1}{\beta}}$$

so when Ic =0 mA, Vce = 10 V
when Vce = 0, V Ic =4.989 mA



MULTISIM RESULTS FOR PART 2





Calculations (PART1 and PART2) calculate All Currents using the Measured Voltages

PART1

$$\mathrm{IC} = \frac{\mathrm{Vc}}{\mathrm{Rc}} = \frac{10 - 6.46}{1k} = 3.54\ mA$$

$$\mathrm{IE} = \frac{\mathrm{VE}}{\mathrm{RE}} = \frac{3.555}{1k} = 3.55\ mA$$

$$\mathrm{IB} = \frac{\mathrm{VBB} - \mathrm{VB}}{\mathrm{RB}} = \frac{5 - 4.254}{33K} = 0.0226\ mA$$

PART2

$$\mathrm{IC} = \frac{\mathrm{Vc}}{\mathrm{Rc}} = \frac{1.752}{1k} = 1.725\ mA$$

$$\mathrm{IE} = \frac{\mathrm{VCC} - \mathrm{VE}}{\mathrm{RE}} = \frac{10 - 8.24}{1k} = 1.76\ mA$$

$$\mathrm{IB} = \frac{\mathrm{VB}}{\mathrm{RB}} = \frac{7.527}{1M} = 0.007527\ mA$$