



University of British Columbia
Electrical and Computer Engineering
ELEC201- Circuit Analysis I

Lab 5 – BJTs at DC

Due: Right at the end of the session.

	1	On time
	2	Breadboard prototype from home
	3	Pre-laboratory
	4	Clean work area and reset instruments after experiment
	5	Experiment complete

Date of lab session: _____

Laboratory section: _____

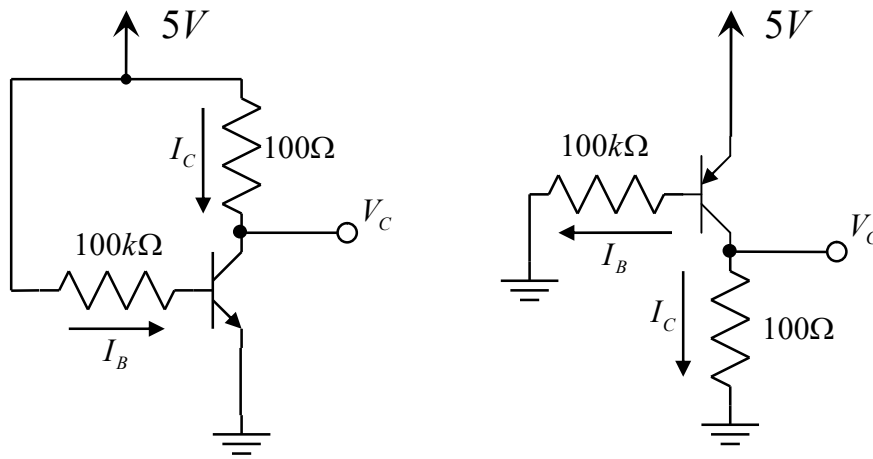
Std	Name	Std #	TA
1			
2			
3			

PRE-LABORATORY

- 1) Find, save, or print the datasheet for the transistors 2N3904 and 2N3906.
- 2) Assemble the two circuits for part 1 of the laboratory.
- 3) Compute R_1 and R_2 for part two of the laboratory.

LABORATORY

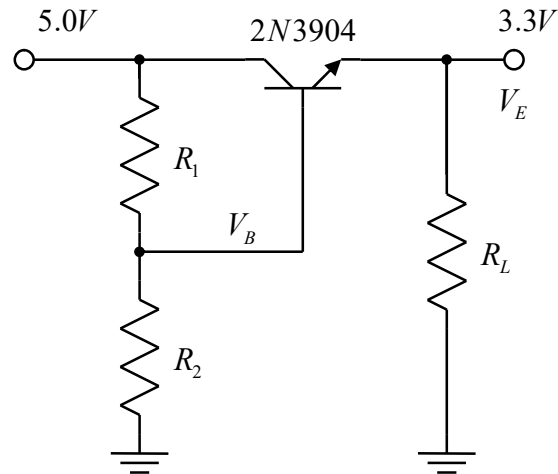
- 1) The two circuits below can be used to measure the base and collector currents for NPN (left) and PNP (right) bipolar junction transistors. With measured¹ values of I_B and I_C , the β of the transistor can be computed. Pick three 2N3904 and three 2N3906 transistors from your kit and complete the table that follows by measuring I_B and I_C and computing β for each one of them. Make sure the transistors are not saturated by checking V_C .



BJT	I_B	I_C	β
2N3904 #1			
2N3904 #2			
2N3904 #3			
2N3906 #1			
2N3906 #2			
2N3906 #3			

¹ You can also measure the voltage drop across the base and collector resistors and calculate the base and collector currents.

- 2) The circuit shown below is often used to step down a regulated DC voltage to a required level while providing sufficient current to the load resistor R_L . If the input voltage is 5.0V and the required voltage output is 3.3V, select resistors R_1 and R_2 so that the circuit works² with a load resistor R_L of 100 Ω , 500 Ω , or 1k Ω . Assemble the circuit and measure the voltages V_B , V_E , and V_{BE} for each load resistor.

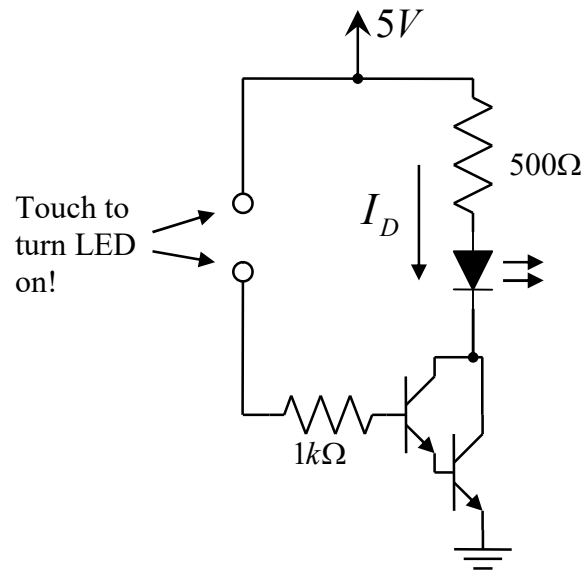


R_1	
R_2	

R_L	V_B	V_E	V_{BE}
100 Ω			
500 Ω			
1k Ω			

² A 5% to 10% difference in V_E from the expected value is often acceptable.

- 3) The resistance of human skin³ can range anywhere from a few $k\Omega$ to several $M\Omega$. We can use the skin resistance to turn a transistor on by closing the circuit that provides the base current. Unfortunately due to the potentially large resistance of human skin, the base current may not be sufficient to force the transistor into saturation. For example, if we need a large collector current to turn on an LED we will need a transistor with a very large β . The circuit below shows a Darlington transistor pair whose β is approximately the product of the β of the two transistors that form it. Assemble the circuit below and show that by touching both contacts with your finger the LED lights on. Measure I_D when the LED is turned on.



I_D	
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³ You can measure the resistance of your skin with the multimeter.