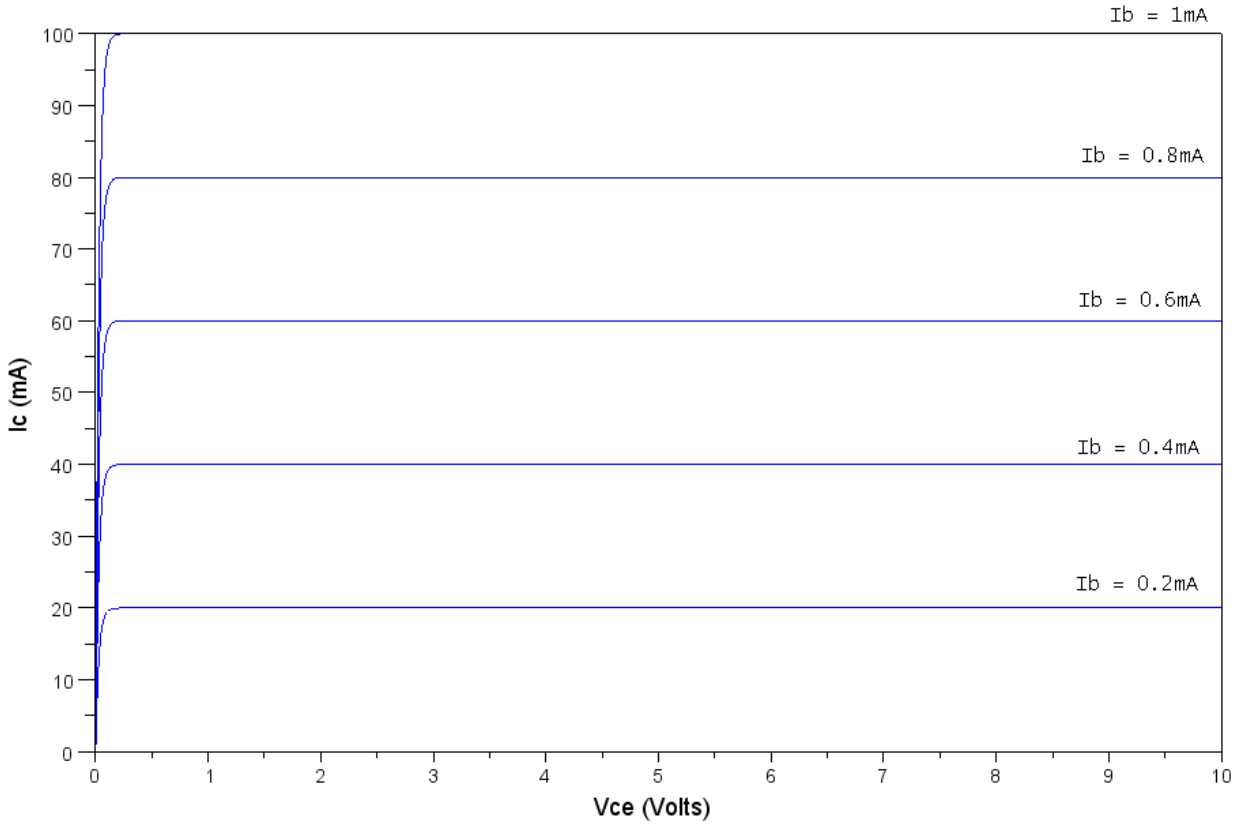
ECE 320 - Homework #6

Transistors, Switches, and H-Bridges. Due Monday February 20th, 2017

1) The VI characteristics for an NPN transistor are shown below.

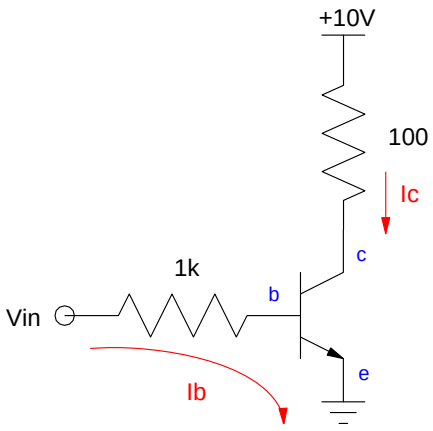
- Label the off / active / saturated regions
- From this plot, determine the current gain, β



2a) Draw the load-line for the following circuit on the above VI plot.

2b) Determine the operating point (Q-point) when

- Vin = 0V
- Vin = 1V
- Vin = 2V



Note: The transistors we have in lab are

	Part	Beta	max(Ic)	Vce(sat)
NPN	3904	100	100mA	0.2V
	TIP112	1,000	2A	0.9V
PNP	3907	100	100mA	0.2V
	TIP117	1,000	2A	0.9V

Transistor Switch

3) Design a circuit so that your cell-phone (or a signal generator) can drive an 8-Ohm speaker

Input: 0V / 3V square wave, capable of driving 10mA

Output: 8 Ohm speaker

Relationship:

- When Vin = 0V, 0mA flows through the speaker
- When Vin = +3V, +XmA flows through the speaker

where

- X = 100mA (if you're using a 3904 transistor)
- X = 500mA (if you're using a TIP112 transistor)

4) Simulate your design in PartSim and verify its operation at 0mA and XmA. (note: if the transistors are saturated, Vce = Vce(sat))

H-Bridge

5) Design a circuit so that your cell-phone (or a signal generator) can drive an 8-Ohm speaker

Input: 0V / 3V square wave, capable of driving 10mA

Output: 8 Ohm speaker

Relationship:

- When Vin = 0V, -XmA flows through the speaker
- When Vin = +3V, +XmA flows through the speaker

6) Simulate your design in PartSim and verify its operation at +100mA and -100mA. (note: if the transistors are saturated, Vce = 0.2V)

Lab)

7) Build one of these two circuits and verify their operation with a signal generator (or your cell phone with a function generator app).