

ECE 320 - Homework #5

Transistor Theory, Transistor as a Switch, H-Bridge. Due Monday, September 26th

Assume

- NPN: 3904 Transistor, $\beta = 100$, $\max(I_c) = 200\text{mA}$, $\max(V_{ce}) = 40\text{V}$, \$0.06 ea.
- PNP: 3907 Transistor, $\beta = 100$, $\max(I_c) = 200\text{mA}$, $\max(V_{ec}) = 40\text{V}$, \$0.07 ea.

Transistors:

1) The VI characteristics for a transistor are given in the following graph.

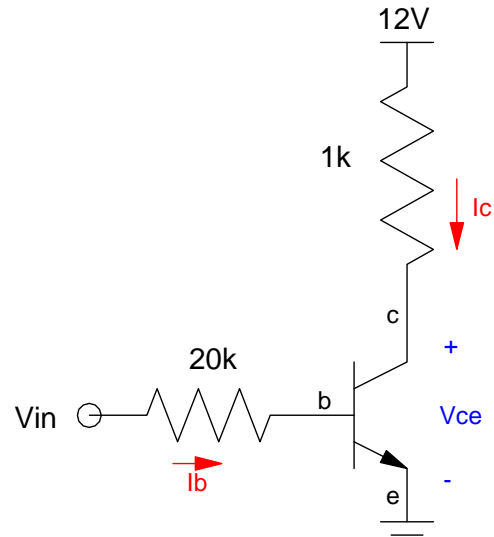
- Label the Off - Saturated - and Active regions on this graph.
- Determine the current gain, β , from this graph.

2) For the circuit to the right

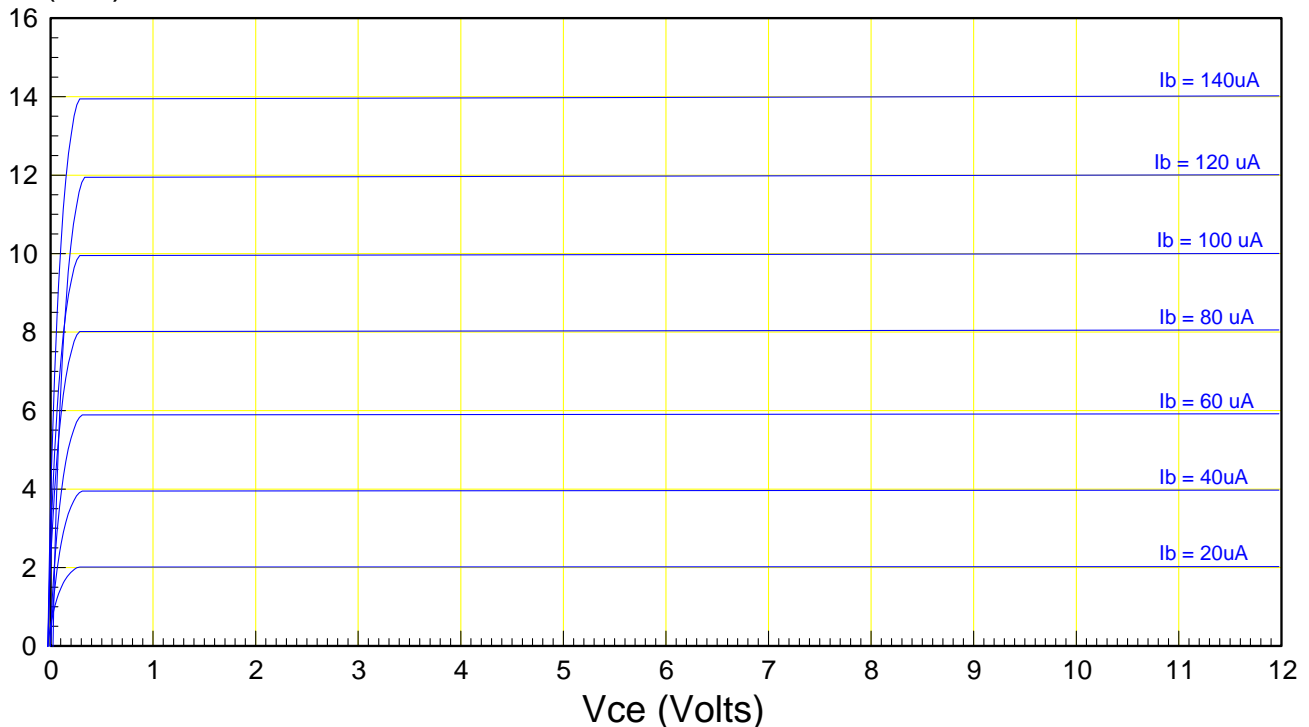
- Draw the load line

3) Determine the Q-point (V_c , I_c) when

- $V_{in} = 0.5\text{V}$
- $V_{in} = 3\text{V}$
- $V_{in} = 5\text{V}$



I_c (mA)



Transistor Switches:

4) Design a circuit which allows you to turn on and off a 3W LED with the function generator:

Input: 0V / 5V signal capable of driving 20mA

Output: 3W LED. $V_f = 3V @ 1A$

Relationship:

- 0V in = 0mA to the LED
- 5V in = 100mA to the LED (something the 3904 transistor is capable of)

H-Bridge

5) Design an H-bridge to drive +/- 100mA through an 8-Ohm speaker

Input: Four signals (A,B,C,D), each 0/5V capable of 20mA

Output: 8 Ohm Speaker

Relationship:

- Setting (A, B, C, D) to different voltages allows you to drive the speaker at +100mA, 0mA, or -100mA
- Tolerance: 10%

Lab:

6) Simulate in PartSim (or similar program) problem 3, 4, or 5

7) Build in lab either problem 3, 4, or 5.