ECE 320: Final - Part 2. Name

BJT Transistors & MOSFET Circuits - October 26, 2016

1) Draw the load line for the following circuit. Compute and show on the load line Ib, Ic, and Vce if $\beta = 100$.

Load Line	Ib	Ic	Vce



2) Determine the voltages for the following DTL logic gate. Assume $\beta = 100$

V1	V2	V3	V4



- 3) Design a Schmitt Trigger which outputs
 - +10V when R > 6k Ohms
 - 0V when R < 4k Ohms, and
 - Is unchanged for 4k < R < 6k



4) Assume a Schmittt Trigger outputs 0V / 10V and is capable of driving 20mA. Design a circuit which allows the Schmitt Trigger to turn on and off a 10W LED at 1A.

Vin (output of the Schmitt Trigger)

• 0V / 10V binary signal, capable of driving 20mA

LED Specifications:

- Vf = 5V @ 2A
- 1000 Lumens @ 2A

Transistor Specifications

- max(Ic) = 3A
- $\beta = 100$
- Vce:sat = 0.2V

+	
Schmitt	Vin
Trigger	0V / 10V
- /	Capable of 20mA



5) The VI characteristics of a MOSFET are shown below. Determine

• The transconductance gain, kn, and

• Vg so that the MOSFET behaves like a 10 Ohm resistor in the following circuit.

Assume Vt = 1V (turn-on voltage)

$I_{ds} = k_n \left(V_{gs} - V_t - \frac{V_{ds}}{2} \right) V_{ds}$ ohmic region						
$I_{ds} = \frac{k_n}{2} (V_{gs} - V_t)^2 \qquad saturated region$						
kn	When the MOSFET behaves as a 10 Ohm resistor					
	Vg	Ids	Vds			



Bonus! In the 2012 Presidential Election, 312,076 votes were cast in North Dakota. If all of the students in North Dakota votes, what percentage of this is students?