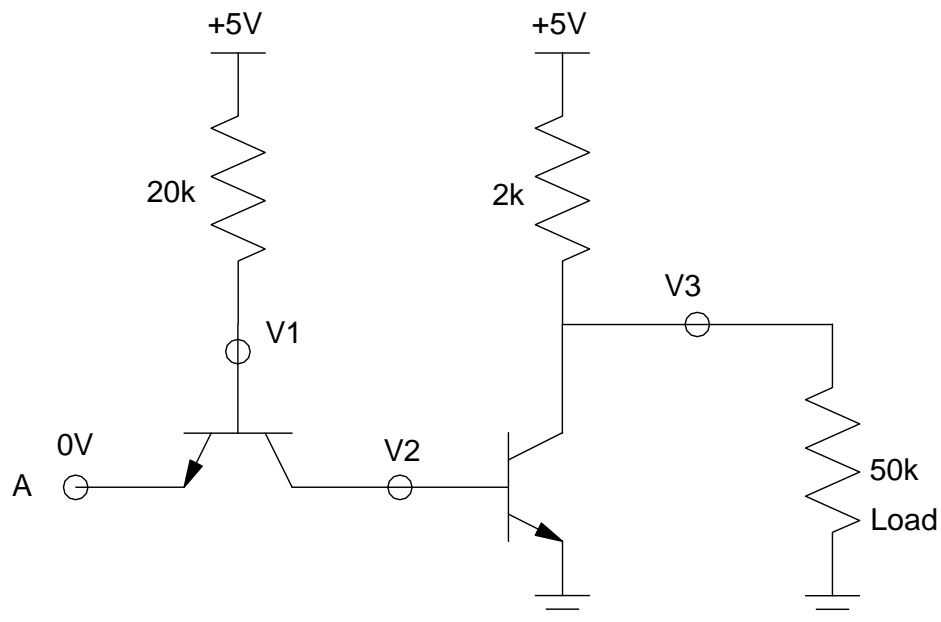


ECE 320: Quiz #8 Name _____

March 11, 2015. TTL Logic, MOSFETs

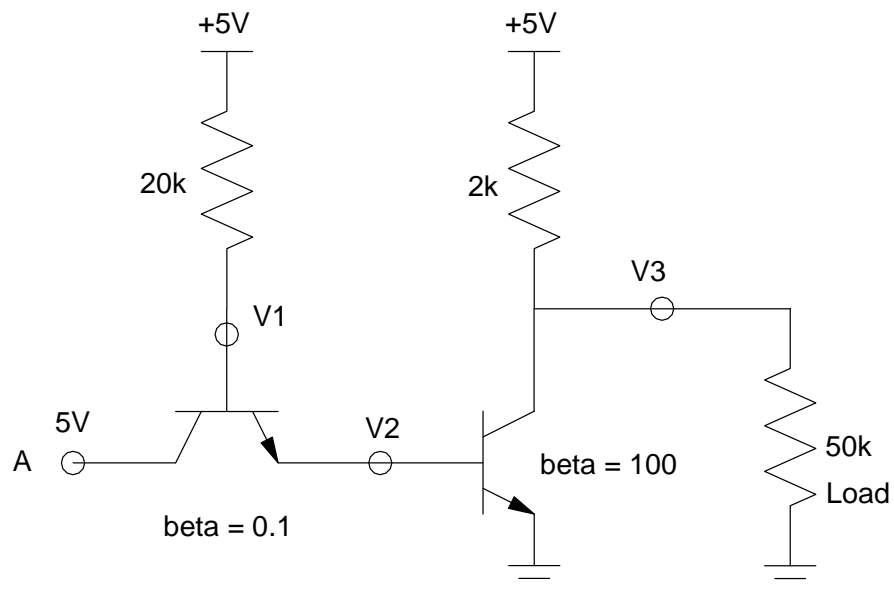
1) The following is a TTL inverter with 0V in driving a 50k load. Determine the voltages V1 .. V3.
Assume $\beta = 100$.

V1	V2	V3



2) The following is a TTL inverter with +5V in driving a 50k load. Determine the voltages V1 .. V3.
Assume $\beta = 100$

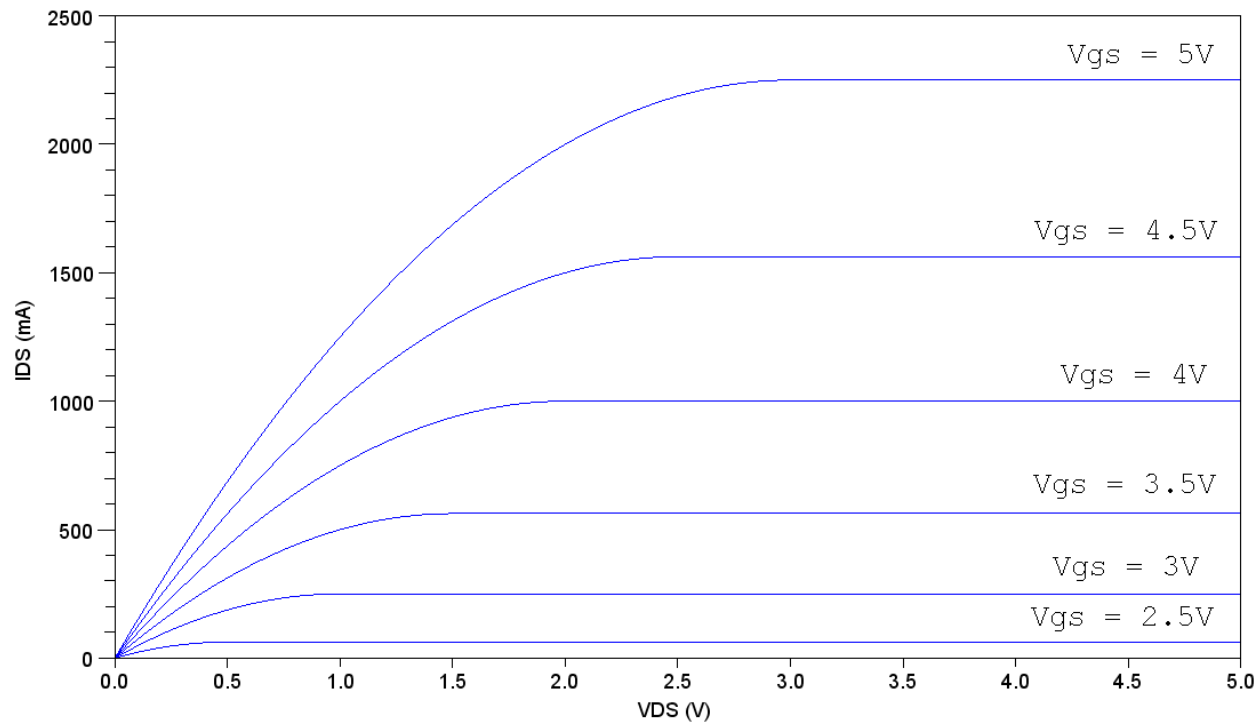
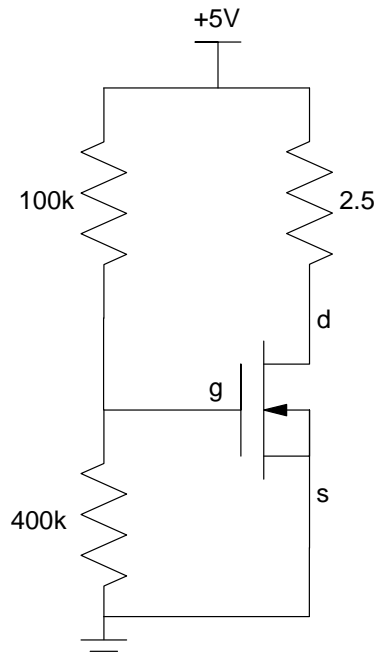
V1	V2	V3



- 3) The VI characteristics for a MOSFET gate are given below.
- Determine the parameter, K_n
 - Draw the load line for this circuit, and
 - Determine the operating point.

Assume $V_{tn} = 2.0V$ (turn on voltage)

Load Line	V_{ds}	I_{ds}
(show on graph below)		



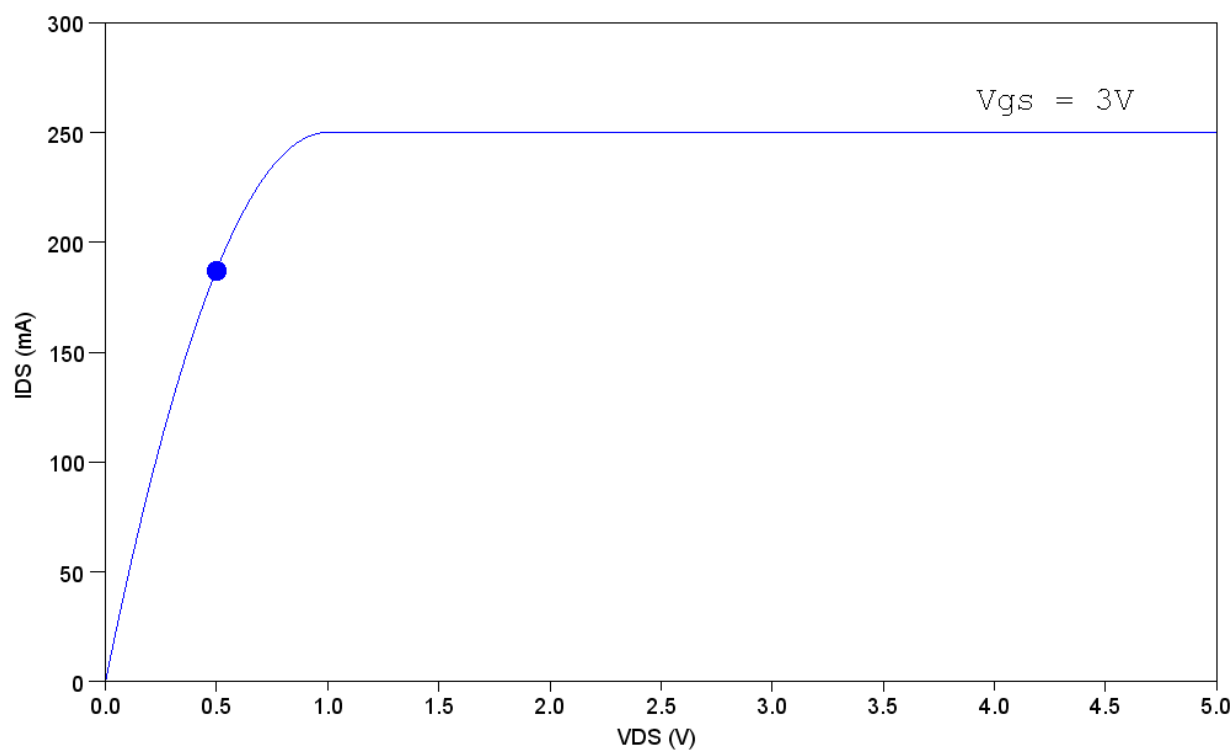
4) The V/I characteristics for a MOSFET are shown below with $V_{tn} = 2V$, $V_{gs} = 3V$. Compute I_{DS} when $V_{DS} = 0.5V$ (shown on plot).

Off: $I_{ds} = 0$

Saturated: $I_{ds} = \frac{K_n}{2}(V_{gs} - V_{tn})^2$

Ohmic: $I_{ds} = K_n\left(V_{gs} - V_{tn} - \frac{V_{ds}}{2}\right)V_{ds}$

Operating Region Off - Ohmic - Saturated	K_n	V_{ds}	I_{ds}
		0.5V	



5) Design a switch using an n-channel MOSFET to turn on and off a 50W LED with a 0V / 5V input.

Assume the MOSFET characteristics are

- $V_{tn} = 2V$
- $R_{ds} = 0.01 \text{ Ohms @ } V_{gs} = 5V \text{ @ } I_{ds} = 5A$

Assume the LED characteristics are

- $V_f = 20V \text{ @ } 2.5A$
- 5,000 Lumens @ 2.5A

Bonus! Commercial Photo-Voltaic cells have an efficiency of 12% to 17% with some research cells as high as 46%. For comparison, what is the efficiency of photosynthesis (i.e. green plants)?