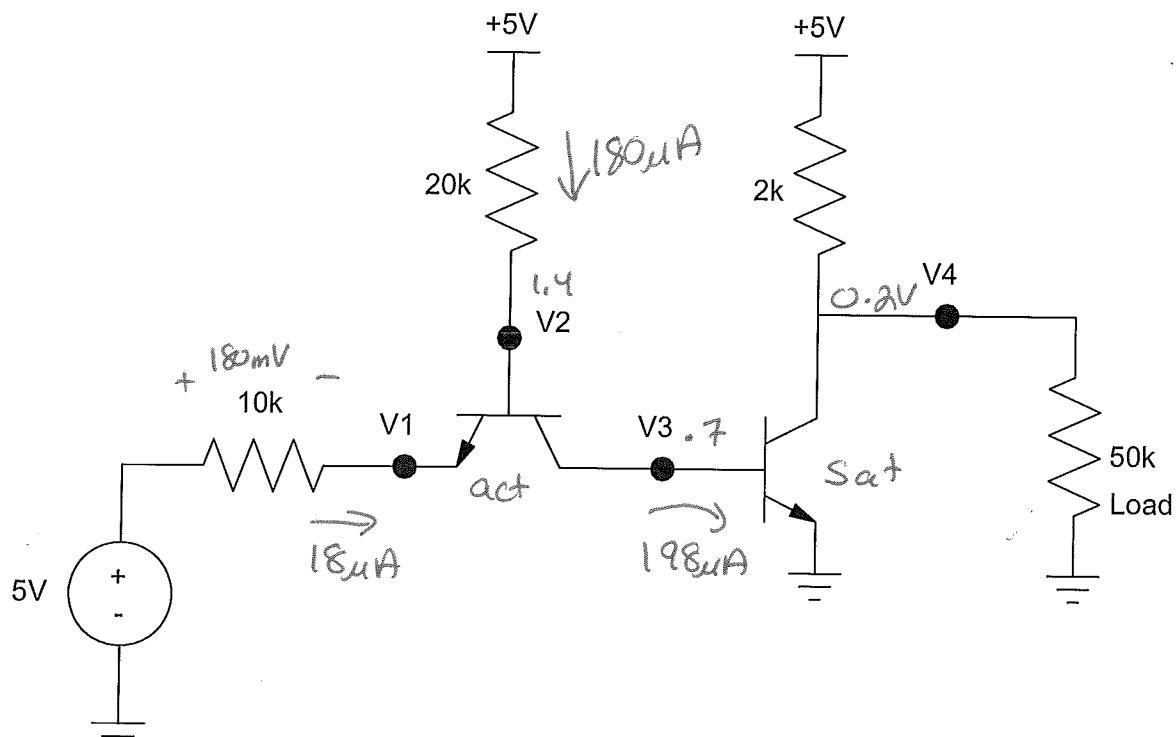


ECE 320 - Quiz 7: Name _____

TTL Logic, MOSFET gates, Schmitt Triggers. October 22nd

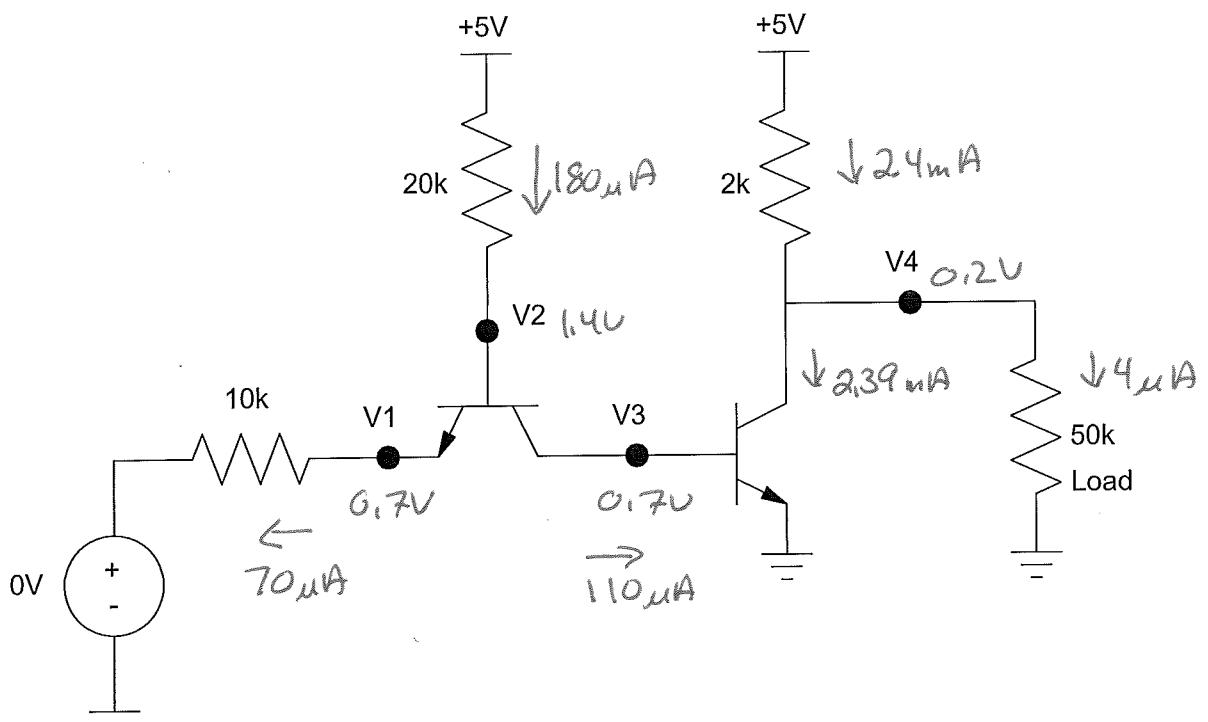
- 1) Determine the voltages and currents for the following TTL NAND gate. Assume $\beta = 100$ (npn transistor as shown), $\beta = 0.1$ (npn transistor with the collector and emitter used in reverse)

V1	V2	V3	V4
4.82V	1.4V	0.7V	0.2V



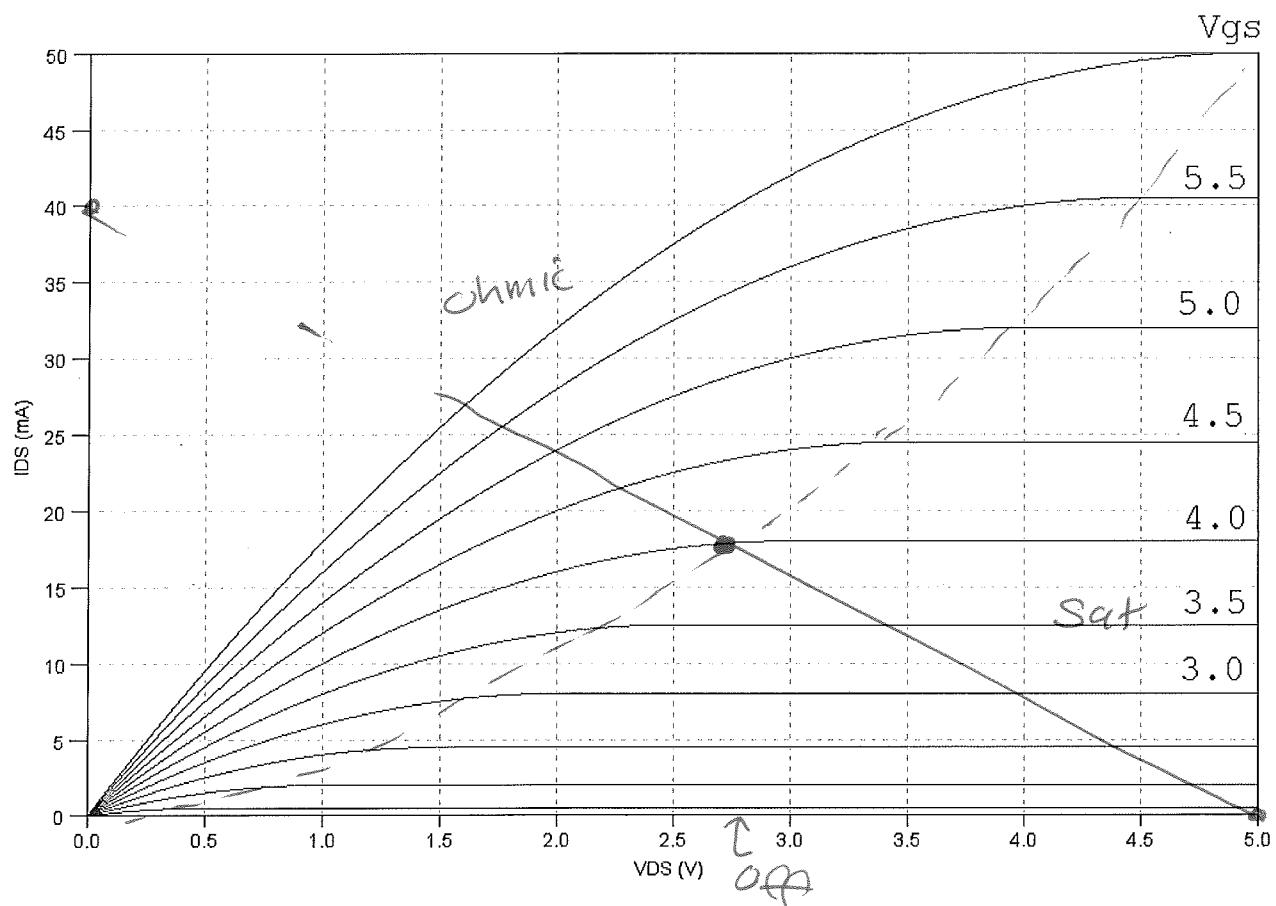
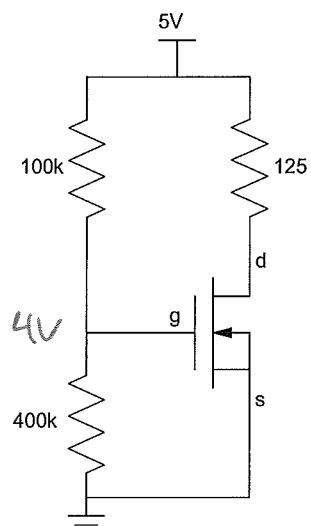
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V1	V2	V3	V4
0.7V	1.4V	0.7V	0.2V



- 3) The VI characteristics for an n-channel MOSFET ($V_t = 1V$) are shown below. Determine the operating point for the circuit to the right

Regions (Ohmic / saturated / off)	Load Line
show on graph below	Show on graph below
Vds	Ids
2.7V	18mA



$$V_t = 1V$$

4) A MOSFET has the following characteristics:

Part Number: APT6M100K-ND

Rds(on) = 2.5 Ohm @ Vgs = 10V, Ids = 3A

Current - Continuous Drain (Id) @ 25°C 6A

Threshold Voltage: Vt = 4V

Determine the constant, kn, and the resistance when Vgs = 5V and Ids = 100mA

$$\text{Ohmic: } I_{ds} = k_n \left(V_{gs} - V_t - \frac{V_{ds}}{2} \right) V_{ds}$$

$$\text{Saturated: } I_{ds} = \frac{k_n}{2} (V_{gs} - V_t)^2$$

kn	Rds @ Vgs = 5V, Ids = 100mA
0.1778	5.79Ω

$$3 = k_n \left(10 - 4 - \frac{7.5}{2} \right) 7.5$$

$$k_n = 0.1778$$

$$10\text{mA} = (0.1778) \left(5 - 4 - \frac{V_{ds}}{2} \right) V_{ds}$$

$$V_{ds} = 0.0579 \quad \text{or} \quad 1.9421$$

$$R_{ds} = \boxed{5.79\Omega} \quad 194.2\Omega$$

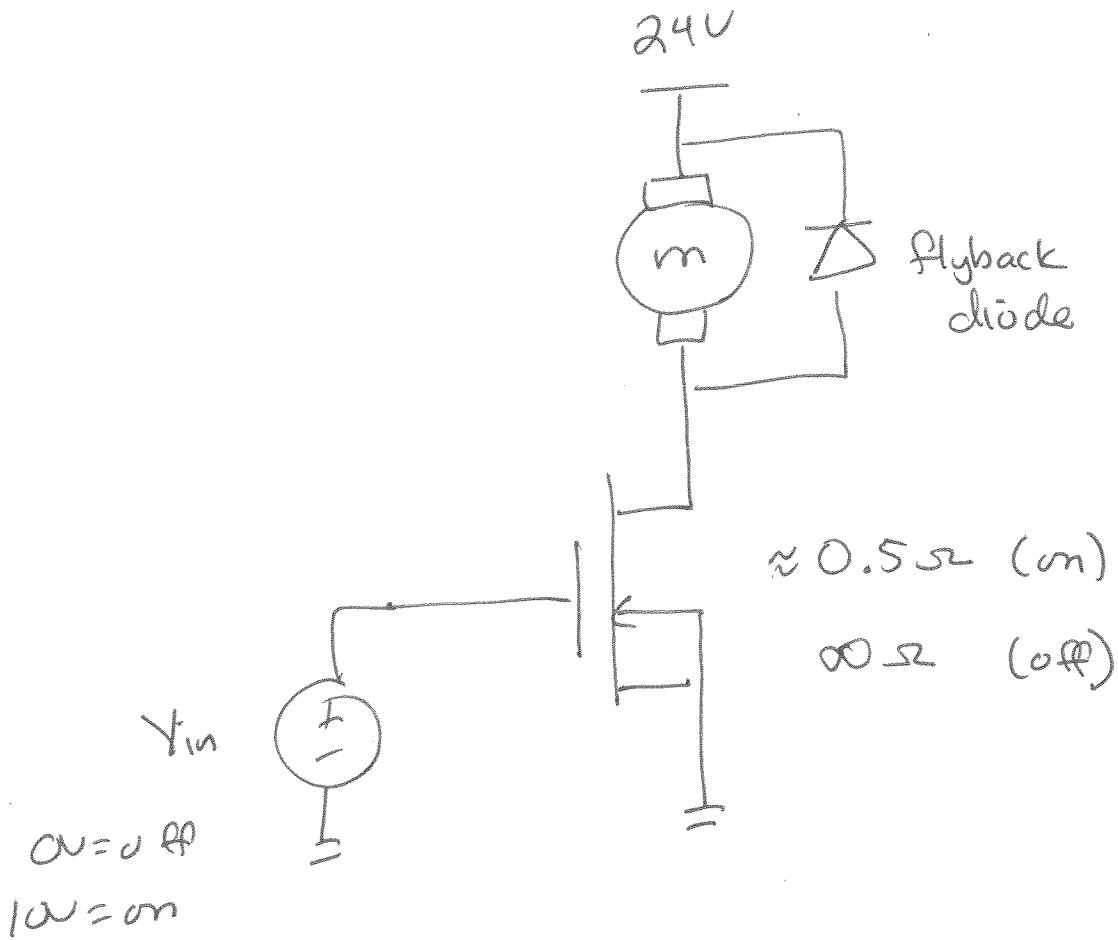
↑
stray
solution

5) Design a circuit to turn on and off a DC motor with a 0V/10V input using an n-channel MOSFET. Assume

The motor draws 2A @ 24VDC.

The turn on voltage for the MOSFET is 4.0V

The resistance of the MOSFET is 0.5 Ohms @ V_{gs} = 10V @ I_{ds} = 5A.



Colbert Bonus! Which of the following are named after Steven Colbert?

- Aptostichus stephencolberti (species of trapdoor spider)
- Agaporomorphus colberti (Venezuelan diving beetle)
- Diamphipnoa colberti (Chilean stonefly)
- Aleiodes colberti (parasitic wasp from Ecuador)
- Emma Colberti (actress in yogurt commercials)

all four