09/09/03

EE 42 – Introduction to Electronics for Computer Science

Fall 2003, **Prof. A. R. Neureuther**
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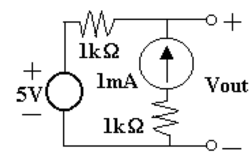
Course Web Site http://www-inst.eecs.berkeley.edu/~ee42/

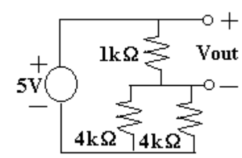
Problem Set # 3

Due:1 PM Sep 17th, 2003 in box outside <u>240</u> Cory

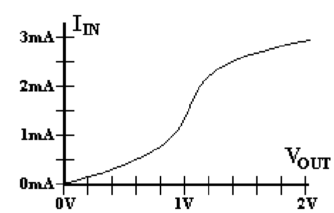
Announcements:
Homework is like a mastery test, and you do not need to be perfect to demonstrate mastery. The goal is to be 80%+ on every problem, and grading will reflect this goal.
Reading: Schwarz and Oldham 3.2-3.4, 8.1, Handout



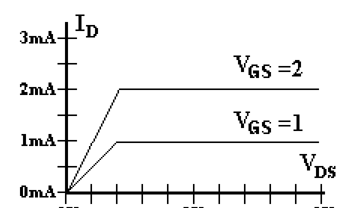
3.1 Thévenin and Norton Equivalents: Use the circuit to the right.
- a) Find V_{OC} and I_{SC}.
- b) Sketch I_{OUT} vs $V_{OUT.}$
- c) Find the Thevenin equivalent circuit.
- d) Find the Norton equivalent circuit.
- e) Show that R_{TH} can be found by turning the sources to zero.



3.2 Working with Loads:
- a) Provide the Thevenin equivalent circuit
- b) Suppose <u>a load</u> that is to be attached to the circuit is measured to have an IV characteristic as follows:
  When the load is attached to the circuit, use the load-line (graphical) method to find I_{IN} and V_{OUT} for <u>the circuit</u>.
- c) What is the power <u>into</u> the load?
- d) Determine the power out of the <u>circuit's</u> voltage source.



3.3 More Load-Line Analysis: Transistors have three terminals, unlike the two-terminal devices we have seen so far. These are termed source, drain and gate (s, d, g). A plot of I_D versus V_{DS} is given to the right.
- a) Suppose you take the circuit from 3.2 and hook it up to the transistor such that it provides the drain to source voltage and the current to drain. What are some possible I_{IN} and V_{OUT} combinations where the entire circuit can operate?



3.4 Transient Analysis: Suppose the circuit to the right remains in the depicted state for a very, very long time. At the same time that the switch is flipped to close the circuit, a timer is set off (time t = 0s.)
- a) Find an expression $V_c(t)$ for the voltage on the capacitor vs time.
- b) Make a plot of voltage on the capacitor versus time.
- c) Determine the time at which the capacitor is halfway charged to the voltage on the voltage source.
- d) Extend a line from (t, V) = (0, 0) with slope = $dV_c(0)/dt$. Where does the slope intersect the 5V line? The lines will intersect at a special time. What is this time?