

EECS 1 Homework 5
Due in class Wednesday Mar. 3, 2004

Reminder: Midterm has been shifted to Wednesday Mar. 10

Read Sec. 16.3 (the ThinkJet Printer – a capsule description of the some things that happen between the conception of a new device and its appearance in stores). Ch. 21 (“What can you do with these components” -- you don’t know about diodes, transistors or op-amps yet). Secs. 25.1-25.3 (semiconductors, diodes).

Problem 1. (20 points) Prob. 20.7 – Rules of thumb regarding capacitor charging and discharging. Note that when properly plotted on semi-logarithmic paper (available on-line in the front of the Lab Manual), the exponential term in the charging/discharging will yield a straight-line plot.

Prob. 2 Prob. 20.10

Prob. 3. Prob. 20.8 (interrupting current flowing through an inductor). You’ll find a surprisingly large voltage is generated across the switch in this problem.

Prob. 4. In class you were given a formula that expresses voltages (or currents) in first-order transient circuits, like a circuit with a resistor and a capacitor, in terms of the voltages (or currents) at the start of the transient and an infinite time later:

$$v(t) = v(\text{infinity}) + [v(\text{zero}) - v(\text{infinity})]e^{(-t/RC)}$$

Use this expression to determine the capacitor voltage for all positive time in the circuit of Fig. 20.12 assuming that (a) a long time ago the switch was in the upper position (connecting the voltage source V_s to the resistor); (b) an additional voltage source having magnitude V_2 , and with its upper terminal the negative terminal, replaces the vertical wire that goes to the other switch terminal; and (c) at time $t = 0$ the switch arm moves downward from being connected to V_s so that it connects instead to the source V_2 .

Hint: Start by writing down the capacitor voltage at time $t = 0^-$ just before the switch is moved, and at infinite positive time. Sketch very roughly the behavior you expect for the capacitor voltage as a function of time from zero to infinite time.