MASSACHVSETTS INSTITVTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.002 – Electronic Circuits
Fall 2001

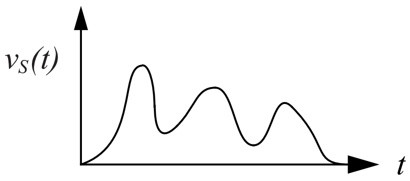
Problem Set 6

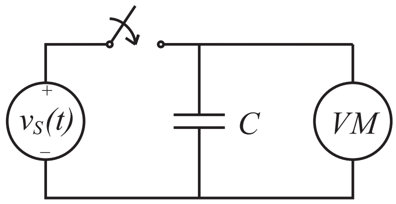
Issued: October 11, 2001 Due: October 19, 2001

Reading:
A&L Chapter 9 and Sections 10.1, 10.2 for Thursday, October 11.
A&L Sections 9.4.3, 10.5.3, 10.3 for Tuesday, October 16.
A&L Chapter 11 for Thursday, October 18.

Problems:

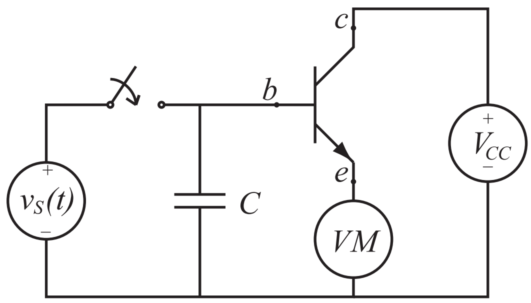
1. The circuit below is designed to measure the peak value of $v_S(t)$. As long as $v_S(t)$ is increasing the switch is closed. As soon as $v_S(t)$ starts to fall the switch is opened and the value of the peak is measured by the voltmeter (VM). The Thévenin equivalent circuit of the voltmeter is simply a resistor of value $10k\Omega$ (i.e., $v_{Th} = 0$). The capacitance of the capacitor is 10μF. Unfortunately, the voltmeter begins to discharge the capacitor as soon as the switch is opened, so the meter must be read quickly.

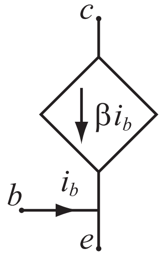




(a) How quickly must the meter be read to insure an accuracy of 5%?

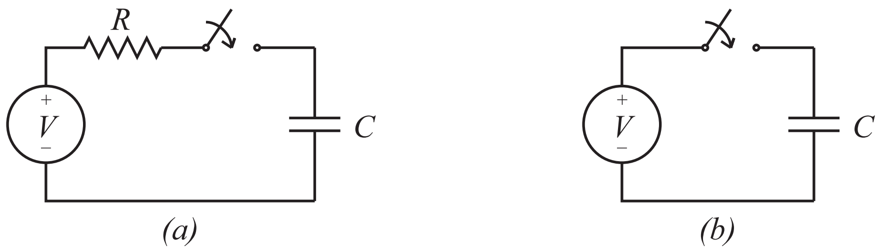
To make the measuring process less frenetic a simple buffer circuit is designed using a bipolar transistor. This circuit is shown below, along with a circuit model for the bipolar transistor. The value of the dependent source paramater β is 200.





(b) Repeat part (a) for this new circuit.

2. The capacitor C in circuit (a) below is initially uncharged. At $t = 0$ the switch is closed.



(a) What is the energy delivered to the capacitor?

(b) What is the energy supplied by the source?

(c) What is the energy dissipated in R?

The resistor R is now removed from the circuit, as shown in circuit (b) above.

(d) Repeat parts (a) and (b) above. Explain your result.

3. Chapter 10, Problem 22, p. 695.

4. Chapter 10, Problem 23, p. 696.