

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.334 Power Electronics

Issued: February 7, 2007

Problem Set 0

Due: February 9, 2007

Reading: KSV Chapters 1 and 2

Problem 0.1

Figure 0.1 shows the circuit diagram of a magnetic stimulator made by an international biomedical electronics company. The pulsed magnetic field generated by the transducer coil (represented by the inductor) can be used in a variety of medical treatments including nerve stimulation. The capacitor is precharged to a Voltage V_x between 0 and 1000 V, and then at $t = 0$ the switch S is closed to trigger the magnetic pulse.

Calculate the following assuming that the switch S and the diode D are ideal:

1. The time response of the coil current after the switch S is closed, as a function of the precharge voltage V_x . (Some types of stimulation require a field with a fast rise time and a slow fall time.)
2. The peak coil current for $V_x = 950$ V.
3. The time t_l at which diode D turns on.
4. The energy dissipated in the resistor for $V_x = 950$ V.

