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6.334 Power Electronics  
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**MASSACHUSETTS INSTITUTE OF TECHNOLOGY**  
**Department of Electrical Engineering and Computer Science**

6.334 Power Electronics

Problem Set 0

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Reading: KSV Chapters 1 and 2

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**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  $t_1$  at which diode  $D$  turns on.
4. The energy dissipated in the resistor for  $V_x = 950$  V.

