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.