Seminar 10: Lectures 19-20
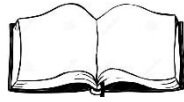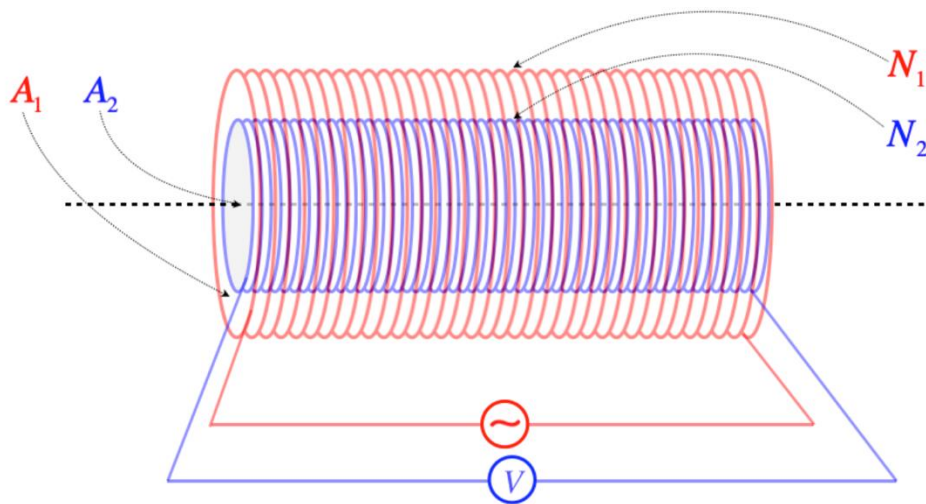
Print and answer all questions found below.
Please bring your completed worksheet to the Seminar Class. [1]

Determine the mutual inductance per unit length between two long solenoids, one inside the other, whose radii are r_1 and r_2 ($r_2 < r_1$) and whose turns per unit length are n_1 and n_2. Consider the value for the permeability of free space (μ_0) known.

A_1 A_2 N_1 N_2

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[1] It is assumed that you have access to the standard physical constants.

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There is a solenoid with an inductance 0.285 mH, a length of $36\,cm$, and a cross-sectional area $6 \times 10^{-4}\,\text{m}^2$.

(a) Find the number of turns of the solenoid.

(b) Suppose at a specific time the emf is -12.5 mV, find the rate of change of the current at that time.

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Question 3

Ignoring any mutual inductance, what is the equivalent inductance of two inductors connected

    (a) in series,

    (b) in parallel?

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Question 4

    Typical large values for electric and magnetic fields attained in laboratories are about 1.0×10^4 V/m and 2.0 T.

    (a) Determine the energy density for each field and compare.

    (b) What magnitude of electric field would be needed to produce the same energy density as the 2.0 T magnetic field?

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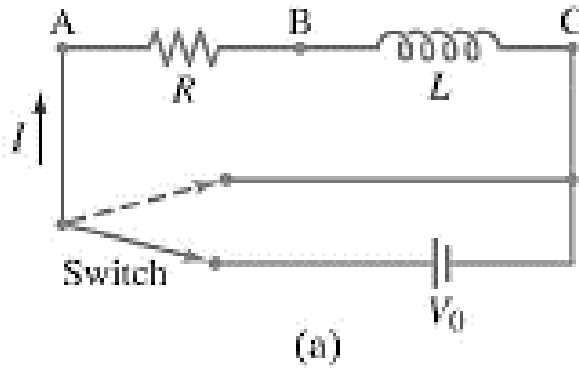
Question 5

After how many time constants does the current in the figure below reach within
(a) 5.0%,
(b) 1.0%, and
(c)   0.10% of its maximum value?
Or (a) 95% (b) 99% (c) 99.9% of its maximum value.

(a)

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A 425 pF capacitor is charged to 135 V and then quickly connected to a 175 mH inductor. Determine

(a) the frequency of oscillation,

(b) the peak value of the current, and

(c) the maximum energy stored in the magnetic field of the inductor.

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Question 7

How much resistance must be added to a pure LC circuit ($L = 350$ mH, $C = 1800$ pF) to change the oscillator's frequency by 0.25%? Will it be increased or decreased?

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Question 8

What is the reactance of a 9.2 µF capacitor at a frequency of
(a) 60.0 Hz,
(b) 1.00 MHz?

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