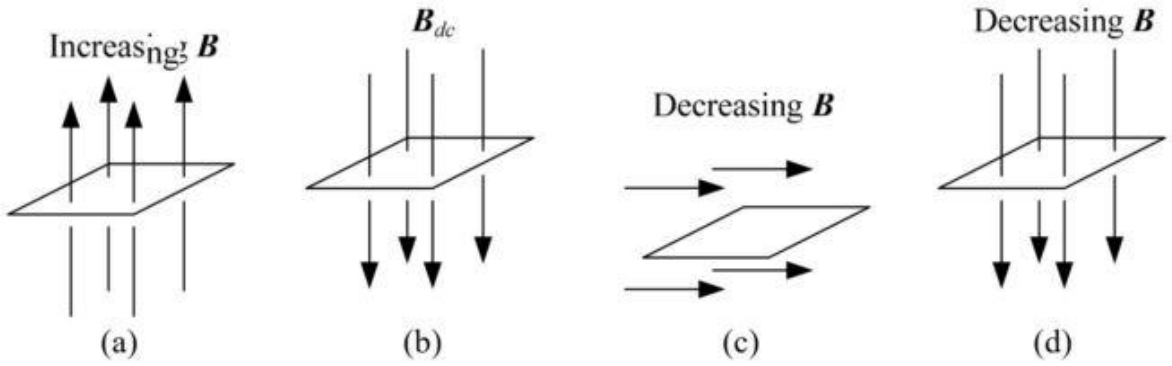
EE382 Homework #2

Assigned: Wed., Jan. 17, 2018
Due: Mon., Jan. 22, 2018
Total Points: 40

(1) Assuming that each conducting loop is not moving, sketch the proper direction for the induced current *I* in each of the four situations indicated below in which ***B*** is increasing, decreasing or not varying (dc) with time. [8 pts]

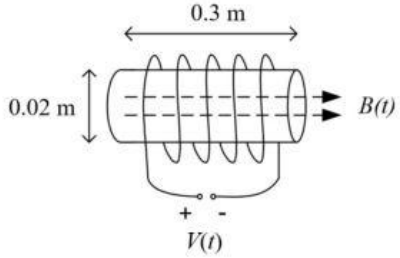


(2) Text Problem 9.1. Stated another way, if a small gap were introduced into the loop, what voltage would be present? Indicate the polarity of this voltage on your sketch of the problem.
(ans.: $V(t) = -0.474\sin(377t)$ V) [7pts]

(3) Text Problem 9.3. Indicate polarity of the current on your sketch of the problem.
(ans.: $I(t) = -12.57\cos(10^4 t)$ A [7 pts]

(4) A square loop with sides 10 x 10 cm is located in free space adjacent to a long straight wire carrying a sinusoidal current of $cos(\omega t)$. The amplitude is 3A and the frequency is 4 kHz. Two sides of the loop are parallel to the wire and located at 5 cm and 15 cm from the conductor, respectively. There is also a small gap in the loop. What is the magnitude and polarity of the induced voltage across the gap? (ans.: *V* = 1.659 mV) [8 pts]

(5) An inductor is formed by tightly winding 500 turns of wire around a circular Teflon rod as shown in the figure, below. This inductor is immersed in a uniform magnetic flux density field, $\boldsymbol{B(t) = 0.03\cos(2\pi \cdot 5 \times 10^4 \cdot t)}$ Wb/m^2 directed along the axis of the coil. Find the inductor voltage *V(t)*. Sketch *V(t)* and ***B(t)*** on the same graph and qualitatively verify that Lenz's law is satisfied if, for example, a resistor was connected across the gap.



(ans.: $V(t) = 1.48 \times 10^3 \sin(2\pi \cdot 5 \times 10^4 \cdot t)$V
[10 pts]