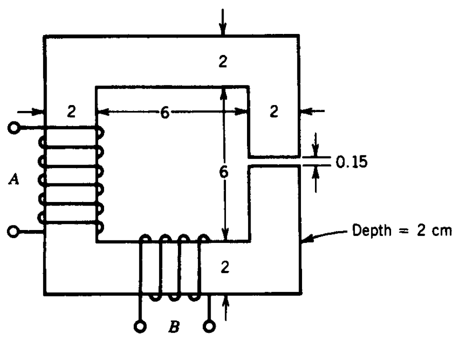
MAGNETIC CIRCUITS

1. An inductor is made of two coils, A and B, having 350 and 150 turns, respectively. The coils are wound on a cast steel core and in directions as shown in the Figure. The two coils are connected in series to a dc voltage.

a) Determine the two possible values of current required in the coils to establish a flux density of 0.5 T in the air gap.

b) Determine the self-inductances L_A and L_B of the two coils. Neglect magnetic leakage and fringing.

c) If coil B is now disconnected and the current in coil A is adjusted to 2.0 A, determine the mean flux density in the air gap.



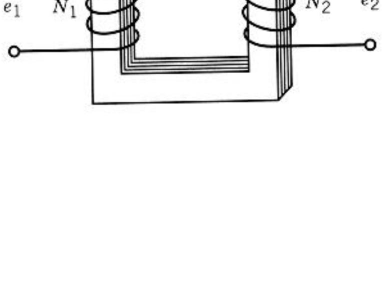
All dimensions in centimeters,
$N_A = 350$, $N_B = 150$

2. A two-winding transformer with a laminated core is shown in the Figure. The winding with N_1=200 turns is connected to a voltage to produce a flux density in the core B=1.2·sin377t. The second winding, with N_2=400 turns, is left open-circuited. The stacking factor of the core is 0.95, i.e. the core occupies 95% of the gross core volume. The gross cross-sectional area of the core is 25cm^2, and μ_r for the core is 10,000. The core length is l_c=90cm.

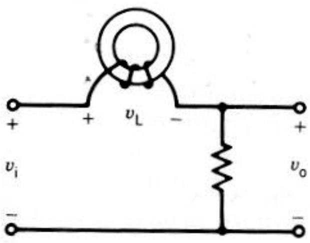
a) Determine the rms value of the applied voltage E_1.

b) Determine the current in the winding.

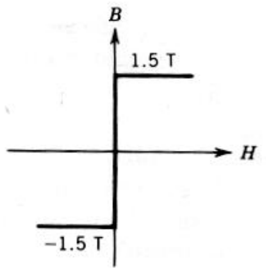
c) Determine the rms voltage E_r induced in the second winding.



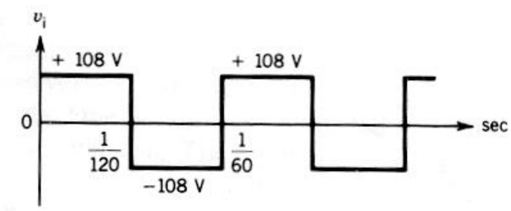
3. In the circuit of Fig. a) a resistanceless toroidal winding of 1000 turns is wound on a ferromagnetic toroid of cross-sectional area $2cm^2$. The core is characterized by the ideal *B*-*H* relation shown in Fig. b). This circuit is excited by a 60 Hz square wave of input voltage (v_i) of amplitude 108 volts, as shown in Fig. c). Determine the switching instant and sketch the waveforms of the voltages v_L and v_0.



(a)



(b)



(c)