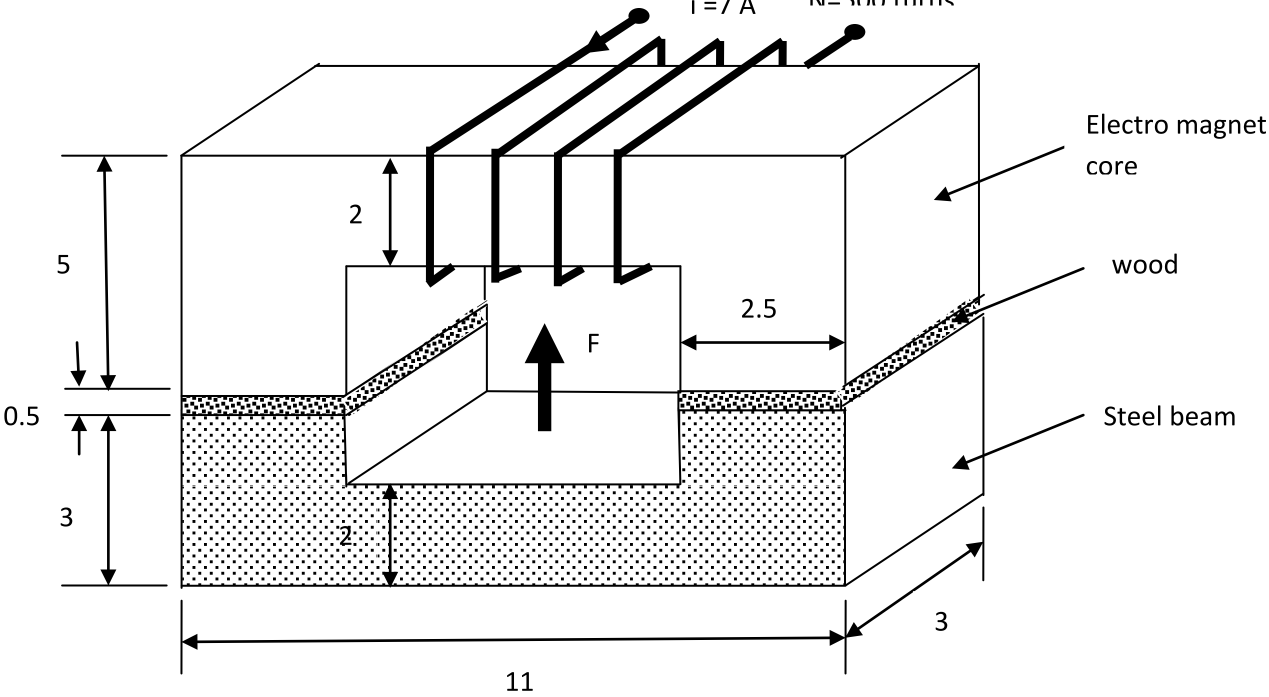
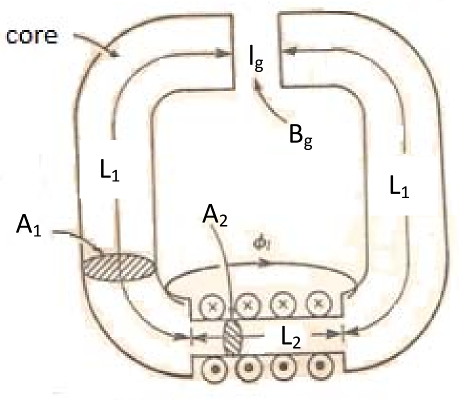
MECHATRONICS

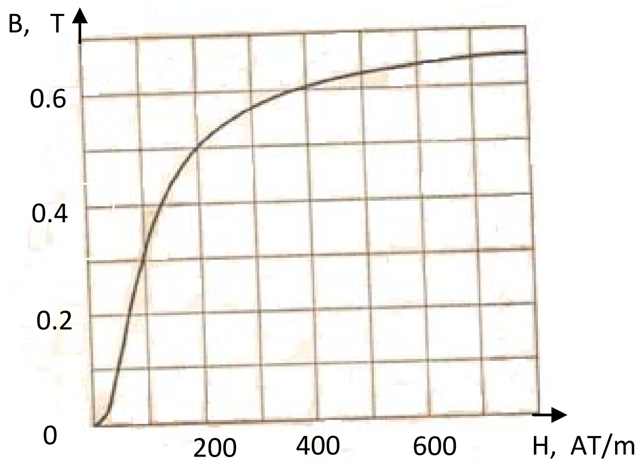
Assignment on "Magnetic Circuits"

1.The electromagnet shown below is used to lift a steel beam. The magnet core has a relative permeability of μ_r =5000, while the steel beam has a relative permeability of μ_r =2000. Calculate the lifting force exerted on the beam. All dimensions are in cm.



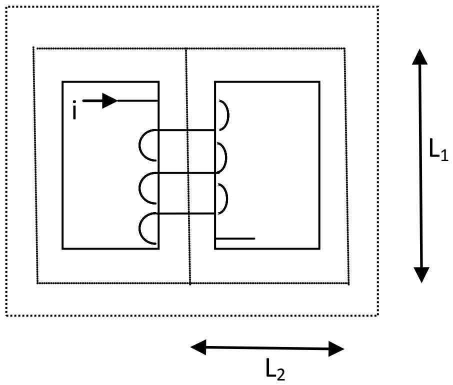
2.A composite magnetic circuit of varying cross section is shown below. The iron portion has the B-H characteristic as shown in the graph. If N=100 turns and L_1=4L_2=40cm, A_1=2A_2=10 cm^2, l_g=2mm, leakage flux Φ_1=0.01 mWeb., calculate the current required to establish an air-gap flux density of 0.6 T.





3. For the magnetic circuit shown in the diagram, the permeability of iron core is constant and denoted by μ. The cross sectional area is given as A. The coil has n turns. Calculate the self-inductance L. How does the self-inductance correlate to the magnetic reluctance?

Parameters: n=500 ; L_1 = 10 cm ; L_2 = 5cm and $\mu = 4000\mu_0$

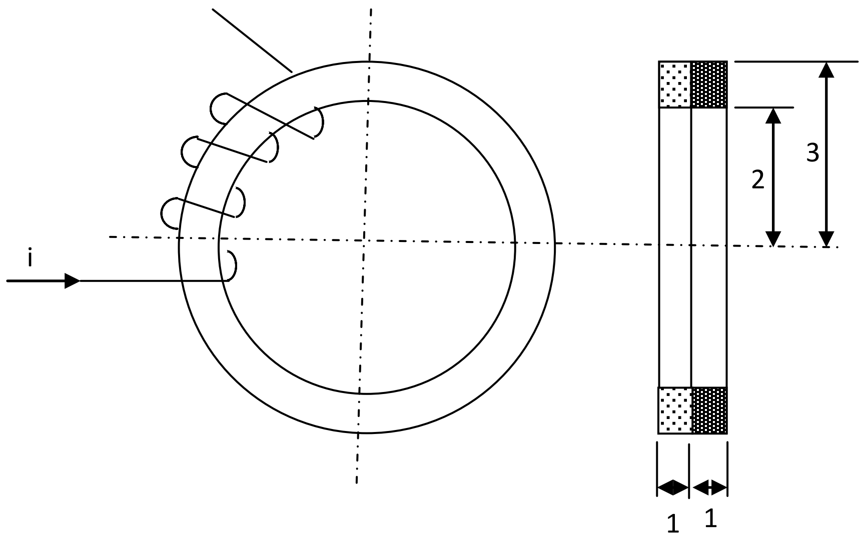


4. The circular core shown below is made of magnetic iron and Permalloy and has 1000 turns winding on it. Core dimensions are in cm.

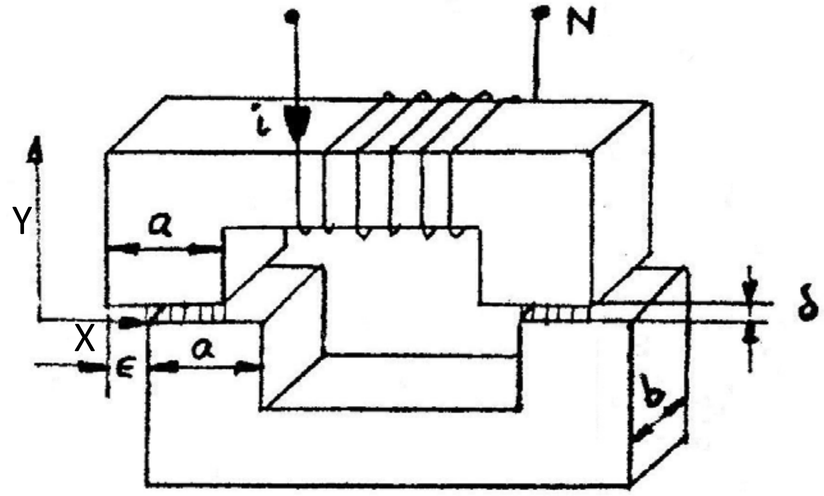
(a) If the current in the coil is 0.01 A, what is the flux density in each of the core materials? Assume that no magnetic flux crosses the boundary between the materials.

(b) What is the total flux in the core?

(c)Is the assumption that no flux crosses the boundary between the materials a good one? Is there some reason for the flux to cross the boundary?



5. Find the forces F_X and F_Y necessary to maintain the ferro-magnetic pieces in the given configuration , if N= 1000 Turns, i= 0.1A, a = 10 mm, b = 5mm, δ = 0.5 mm, ε =1 mm.



6. The circular core shown below is made of magnetic iron and Permalloy and has 1000 turns winding on it to establish a magnetic field. Core dimensions are in cm.

(a) If the current in the coil is 0.01 A, what is the flux density in each of the material?

(b) Calculate the total flux in the core.