Cairo University	**Electrical Power Engineering Dept.**
Faculty of Engineering	**Electromagnetic Fields II**
Fall 2019	**Assignment #1**

Name : **Sc:** **BN:**

Determine the magnitude and direction of the force between two parallel wires 25 m long and 4.0 cm apart, each carrying 35 A in the same direction.

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Fall 2019	**Assignment #2**

Name : **Sc:** **BN:**

Given the time-varying magnetic field $B=(0.5\ \underline{u}_x + 0.6\ \underline{u}_y - 0.3\ \underline{u}_z)\ cos(5000t)$ T and a square filamentary loop with its corners at (2,3,0), (2,-3,0), (-2,3,0), (-2,-3,0), find the time varying current induced in the loop if the total loop resistance equals 400 kΩ.

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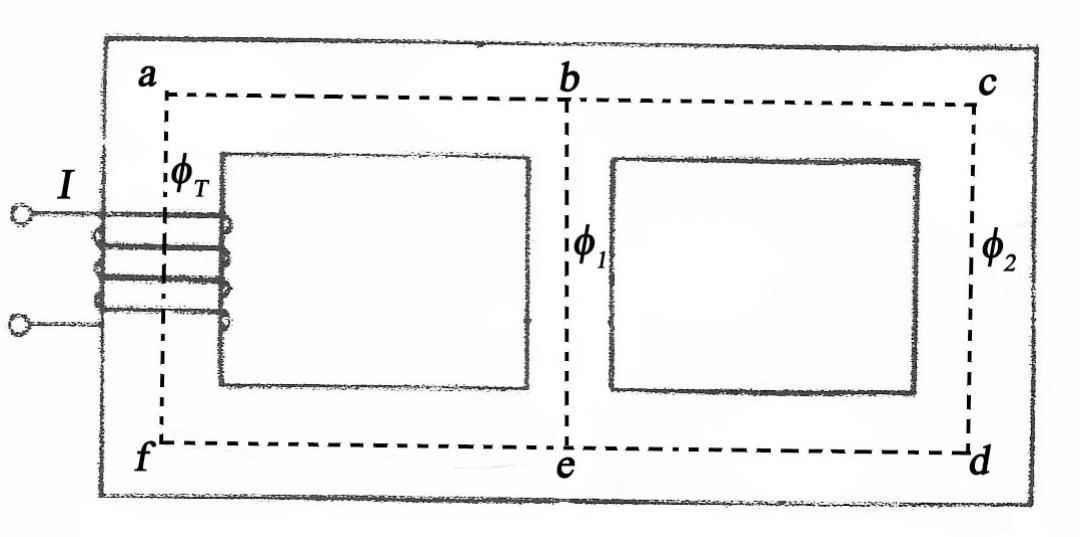
Consider the magnetic circuit in the figure, in which all parts have the same cross section area of 6 cm^2.The coil has 50 turns. The length of section "abef" and section "bcde" = 0.2 m and the length of section "be" = 0.05 m. The core has the following B-H curve. If the value of the Flux ϕ_2 in section "bcde" is $1.5x10^{-4}$ Wb, compute:

H (AT/m)	0	100	200	300	400	500	600	700
B (Tesla)	0	0.8	1.03	1.10	1.22	1.26	1.3	1.32

i. The magnetic field intensity and the AT of the "bcde" section.
ii. The magnetic field intensity and the AT of the "be" section.
iii. The fluxes ϕ_1 and ϕ_T.
iv. The current I of the coil



Name : **Sc:** **BN:**

Repeat problem (2) in sheet (4) if the angle between the coils is α degrees where $\alpha < 90^{o}$.

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For Problem (2) in sheet (5), determine:

- The current flowing in the loop if the loop is short circuited.
- The torque exerted on the loop due to the flow of this current.

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Using curl $\underline{H} = \underline{J}$, Calculate the magnetic field inside and outside a conductor of radius a carrying current with uniform density distribution $\underline{J} = J_o \underline{U}_z$. Hence deduce an expression for the Poynting vector on the surface of the conductor. Calculate also the power absorbed per unit length of the conductor.

Name : **Sc:** **BN:**

a. Write down the expression used to calculate the power loss density in magnetic strips (like those used as transformer steel laminations) when subjected to uniform time harmonic field. Define each symbol used.
b. Reduce (simplify) the above expression assuming that the lamination thickness is smaller than the skin depth.
c. A very long strip of width 0.4 mm, height 20 cm and length 2 m is subjected to external magnetic field of 100 A/m along its length of frequency 50 Hz. The material of the strip has a conductivity of $10^6\ \Omega^{-1}.m^{-1}$ and relative permeability of 3500. Calculate:
   i. The power loss density in W/m^3.
   ii. The percentage error that may arise from using the simplified expressions derived in b to calculate the power loss density.