KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Department of Electrical Engineering

EE 340 Electromagnetic

Homework 7 (Due Monday Dec. 31)

1- The *x*-*y* plane serves as the interface between two different media. Medium 1 (z<0) is filled with a material whose $\mu_r = 6$, and medium 2 (z>0) if filled with a material whose $\mu_r = 4$. If the interface carries current $(1/\mu_o)\,\hat{a}_y$ mA/m, and $\overline{B}_2 = 5\hat{a}_x + 8\hat{a}_z$ mWb/m^2, find $\overline{H}_1$ and $\overline{B}_1$.

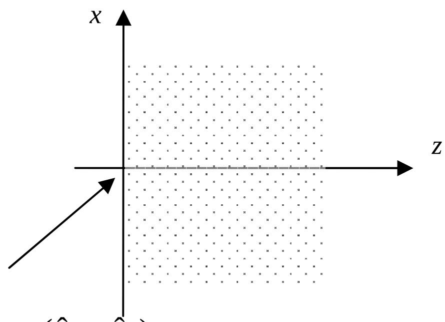
2- An interface at the plane $2x + y = 5$ separates two magnetic materials with relative permeability's of 2 (region 1 $2x + y \geq 5$) and 4 (region 2 $2x + y \leq 5$), respectively. Given that $\overline{H}_1 = 1.2\hat{a}_x + 2.4\hat{a}_y - 0.3\hat{a}_z$ A/m and current sheet on the interface is $\overline{K} = 0.2\hat{a}_z$. Determine $\overline{H}_2$ on the other side of the interface.

3- Consider two infinitely long cylindrical surfaces of radii *a* and *b* ($b > a$). The first has a uniformly distributed current sheet of $K_a\hat{a}_z$ while the second has $-K_b\hat{a}_z$, respectively.

(a) Find the magnetic field everywhere.

(b) Find the ratio between a and b which results in zero magnetic field for $\rho > b$.

4- Consider an electron having initial velocity $\overline{v} = v_o(\hat{a}_z + \hat{a}_x)$ entering a region of uniform magnetic field $\overline{B} = B_o\,\hat{a}_y$ as shown below. Find the electron velocity at both x and z-direction.



$\overline{v} = v_o(\hat{a}_z + \hat{a}_x)$

5- Determine the mutual inductance between a very long striaght wire and a conducting equilateral trianglar loop, as shown in the figure below.