Indian Institute of Technology Gandhinagar

PH101: Physics

Assignment-5   Due on February 07, 2017

Note:

1. Write your **name**, **roll number** and **section** clearly on the answer sheet <u>on the top-right corner</u>. Also put down assignment number and submission date.

2. Deadlines for assignment submission will be followed strictly.

3. Show all the necessary steps clearly and concisely. Avoid scratch work on the main answer sheet and <u>box the final answer</u>.

Problems

1. A current I flows down a long straight wire of radius a. If the wire is made of linear material with susceptibility χ_m, and the current is distributed uniformly, what is the magnetic field at a distance s from the axis? Find all the bound currents. What is the net bound current flowing down the wire?

2. The xy-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 ($z > 0$) is filled with a material whose $\mu_r = 4$. If the interface carries current $\dfrac{1}{\mu_0}\hat{\mathbf{a}}_y$ mA/m, and $\mathbf{B}_2 = 5\hat{\mathbf{a}}_x + 8\hat{\mathbf{a}}_z$ mWb/m² find $\mathbf{H}_1$ and $\mathbf{B}_1$.

3. The magnetic field intensity is H = 1200 A/m in a material when B = 2 Wb/m². When H is reduced to 400 A/m, B = 1.4 Wb/m². Calculate the change in the magnetization M.

4. For the boundary between two magnetic media 1 and 2 having finite current density K, show that $\dfrac{\tan\theta_1}{\tan\theta_2} = \dfrac{\mu_1}{\mu_2}\left[1 + \dfrac{K\mu_2}{B_2\sin\theta_2}\right]$, where θ's are the angles made by the fields B_1 and B_2 with the normal to the interface.

5. In a certain region for which $\chi_m = 19$, $H = 5x^2 yz\hat{\mathbf{a}}_x + 10xy^2 z\hat{\mathbf{a}}_y - 15xyz^2\hat{\mathbf{a}}_z$ A/m. How much energy is stored within the region $0 < x < 1$, $0 < y < 1$, $-1 < z < 2$?