Homework 13
EE 381 Electric & Magnetic Fields (Fall 2024)
Monday, December 2, 2024

1) 8.3
2) A 16 cm long straight thin wire segment carries 12 A in the $\hat{a}_y$ direction in free space. If a magnetic field of $\bar{H} = 7957.75\hat{a}_x + 1989.44\hat{a}_y + 3987.87\hat{a}_z$ (A/m) is applied, find the force on the wire.
3) 8.14 Hint: Use the equation for $\bar{B}$ for an infinitely long straight wire and RHR to find the vector magnetic flux density $\bar{B}_C$ at conductor C due to conductors A and B. Bonus: Find force by A on a 1 m length of C by shifting coordinates to place conductor A along the z-axis, find force in the shifted cylindrical coordinate system, and draw vector on drawing. Repeat for conductor B. Add the two vectors to get overall force.
4) 8.18 Also, find the vector torque on the coil if an external magnetic field of $\bar{H} = 30\hat{a}_z$ kA/m is applied. Assume free space.
5) A tightly-wound, 36-turn, circular, thin wire coil with a 9 cm radius is centered on the origin on the x-y plane in free space. If the loop carries a current of 8 A in the $\hat{a}_\phi$ direction, find the magnetic moment. Also, find the vector torque on the coil if an external $\bar{H} = 7957.75\hat{a}_x + 3987.87\hat{a}_z$ (A/m) is applied.
6) A ferrimagnetic material (ε_r = 9, μ_r = 64) supports a magnetic field of $\bar{H} = 795.775y\hat{a}_x$ (A/m). For, in, or on this material, determine: a) the magnetic permeability, b) magnetic susceptibility, c) magnetic flux density vector, d) magnetization vector, e) bound volume current density, and f) the bound surface current density at Cartesian point (0.1 m, 0.2 m, 0.5 m) on a material surface at z = 0.5 m.

Due Friday, December 6, 2024.