A ferrimagnetic material (ε_r = 9, μ_r = 64) supports a magnetic field of $\bar{H} = 795.775 y\,\hat{a}_x$ (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.

a) $\mu = \mu_r \mu_0 = 64(4\pi \times 10^{-7}) \Rightarrow \underline{\underline{\mu = 8.0425 \times 10^{-5}\ \text{H/m}}}$

b) (8.37) $\chi_m = \mu_r - 1 = 64 - 1 \Rightarrow \underline{\underline{\chi_m = 63}}$

c) (8.36) $\bar{B} = \mu_0 \mu_r \bar{H} = 64(4\pi \times 10^{-7})\,795.775\,y\,\hat{a}_x$

$$\underline{\underline{\bar{B} = 0.064\,y\,\hat{a}_x\ (\text{T})}}$$

d) (8.34) $\bar{M} = \chi_m \bar{H} = 63(795.775y)\,\hat{a}_x$

$$\underline{\underline{\bar{M} = 50{,}133.825\,y\,\hat{a}_x\ (\text{A/m})}}$$

e) (8.30) $\bar{J}_b = \bar{\nabla} \times \bar{M}$

$$\bar{J}_b = \left[\frac{\partial M_z}{\partial y}^{\to 0} - \frac{\partial M_y}{\partial z}^{0}\right]\hat{a}_x + \left[\underbrace{\frac{\partial M_x}{\partial z}}_{\to 0} - \frac{\partial M_z}{\partial x}^{0}\right]\hat{a}_y + \left[\frac{\partial M_y}{\partial x}^{\to 0} - \frac{\partial M_x}{\partial y}\right]\hat{a}_z$$

$$= -\frac{\partial}{\partial y}(50{,}133.825y)\,\hat{a}_z \Rightarrow \underline{\underline{\bar{J}_b = -50{,}133.825\,\hat{a}_z\ \left(\frac{A}{m^2}\right)}}$$

f) (8.31) $\bar{K}_b = \bar{J}_{sb} = \bar{M} \times \hat{a}_n =$ For $z = 0.5\,m \Rightarrow \underline{\hat{a}_n = \hat{a}_z}$

@ (0.1, 0.2, 0.5), $\bar{M} = 50{,}133.825(0.2)\,\hat{a}_x = 10{,}026.765\,\hat{a}_x$

$\bar{J}_{sb} = 10{,}026.765\,\hat{a}_x \times \hat{a}_z \Rightarrow \underline{\underline{\bar{J}_{sb} = -10{,}026.765\,\hat{a}_y\ (\text{A/m})}}$