18PYB101J-Electromagnetic Theory, Quantum Mechanics, Waves and Optics

Module I Lecture-16

Solving Problems

1. The magnetic flux density within a bar of some material is 0.63 Tesla at an H field of 5×10^5 A/m. Compute the following for this material: (a) Magnetic permeability, (b) Magnetic susceptibility, (c) Type of magnetism that you suggest being displayed by the material with reasons.

Sol.: (a) Magnetic permeability,

$\mu = B/H$

$= 0.63/5\times10^5$

$\mu = 0.126 \times 10^{5}$ H/m

$\chi = \mu_r \ 1$

$= \mu/\mu_0 - 1 = 0.126 \times 10^{5}/4\pi \times 10^{7} - 1$

$= 1.003185 - 1$

$\chi = 0.003185$

1. The magnetic flux density within a bar of some material is 0.63 Tesla at an H field of 5×10^5 A/m. Compute the following for this material: (a) Magnetic permeability, (b) Magnetic susceptibility, (c) Type of magnetism that you suggest being displayed by the material with reasons.

(c) Type of magnetism: Paramagnetism since the magnetic susceptibility is positive and low in magnitude.

2. A magnetic material has a magnetization of 3300 A/m and flux density of 0.0044 Wb/m^2. Calculate magnetizing field strength and relative permeability.

Sol.: From $B = \mu_0(H+I)$,

magnetizing field strength, $H= (B/\mu_0)$ I

$= \{(0.0044)/4\pi\times10^{7}\}$ 3300

=3503 .185 3300

H =203. 185 A/m

Relative permeability, $\mu_r= \mu/\mu_0$

$= B/H\mu_0$

$= 0 . 0044/\{203. 185\times4\pi\times10^{7}\}$

μ_r =17 .24

3. The magnetic fled intensity in a piece of a magnetic material is 10^6 A/m. If the susceptibility of the material at room temperature is 1.5×10^{-3}, compute flux density and magnetization of material.

Hint: $B=\mu_0(H+I)$
Ans: B=1.257 T

Hint: Magnetization: $I=\chi H$
Ans: I=1500 A/m