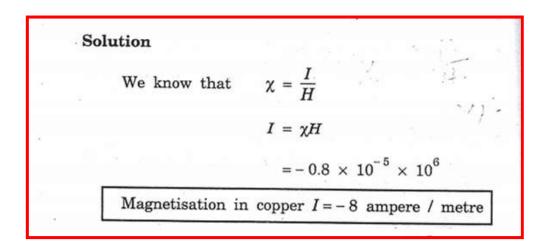
## 18PYB101J-Electromagnetic Theory, Quantum Mechanics, Waves and Optics

**Module I Lecture-4** 

**Solving Problems** 

1. The magnetic field strength of copper is 10<sup>6</sup> ampere/metre. If the magnetic susceptibility of copper is -0.8×10<sup>-5</sup>, calculate the magnetic flux density and magnetisation in copper.

Given data Magnetic field strength  $H = 10^6$  ampere/metre Susceptibility of copper =  $-0.8 \times 10^{-5}$ 



$$\mu_r = 1 + \chi = 1 + (-0.8 \times 10^{-5})$$

$$= 1 - 0.8 \times 10^{-5}$$

$$\mu_r = 0.999$$

$$= \mu H$$

$$= \mu_r \mu_0 H$$

$$= 0.999 \times 4\pi \times 10^{-7} \times 10^6$$

$$= 0.999 \times 4 \times 3.14 \times 10^{-7} \times 10^6$$
Magnetic flux density  $B = 1.26$  weber / metre<sup>2</sup>

2. A magnetic field of 1800 ampere/metre produces a magnetic flux of 3×10<sup>-5</sup> Weber in an iron bar of cross sectional area 0.2 cm<sup>2</sup>. Calculate permeability.

## Given data

Magnetizing field H = 1800 ampere/metre

Magnetic flux  $\phi = 3 \times 10^{-5}$  weber

Area of cross section  $A = 0.2 \text{ cm}^2 = 0.2 \times 10^{-4} \text{ m}^2$ 

## Solution

Magnetic flux density  $B = \frac{\phi}{A}$ 

Substituting the given values, we have

$$B = \frac{3 \times 10^{-5}}{0.2 \times 10^{-4}}$$

 $B = 1.5 \text{ weber / metre}^2$ 

Permeability '
$$\mu$$
' =  $\frac{B}{H}$ 

$$\mu = \frac{1.5}{1800}$$

Permeability  $\mu = 8.333 \times 10^{-4} \, henry/metre$ 

3. A magnetic field strength of  $2\times10^5$  amperes/metre is applied to a paramagnetic material with a relative permeability of 1.01. calculate the values of B and M.

**Hints:** 

$$\mathbf{M} = \mathbf{H}(\mu_r - 1)$$
$$\mathbf{B} = \mu_0(\mathbf{M} + \mathbf{H})$$

Ans: 0.2537 Wbm<sup>-2</sup>