

## ELECTRICITY AND MAGNETISM - II

### Paper-III : Semester—II

Time : Three Hours]

[Maximum Marks : 30

Note : Attempt two questions each from Section A and B carrying 5 marks each, and any five from Section C consisting of 7 short answer type questions carrying 2 marks each.

#### SECTION-A

- I. Derive the relation  $\vec{B} = \mu_0 (\vec{H} + \vec{M})$ , where symbols have their usual meanings, and define  $\vec{B}$ ,  $\vec{H}$  and  $\vec{M}$ . Discuss the difference between  $\vec{B}$  and  $\vec{H}$  as applied to magnetism. 5
- II. Prove that magnetic moment due to orbital motion of an electron must be integral multiple of  $\frac{e\hbar}{4\pi m_e}$ . Hence find the value of Bohr magneton and define it. 5
- III. (a) Explain what do you understand by Hysteresis, Remanence and Coercivity. What is Hysteresis loop? How will you determine the value of remanence and coercivity from a loop? 3  
(b) What type of materials should be used for making (i) Permanent magnet, and (ii) Electromagnet? 2
- IV. What are the characteristics of Diamagnetic, Paramagnetic and Ferromagnetic substance? 5

#### SECTION - B

- V. State and prove Reciprocity theorem in Mutual induction. 5
- VI. State and explain Biot and Savart's law in vector form. Find the magnetic field due to an infinite straight wire carrying current using the above law. 5
- VII. (a) What do you understand by Vector potential? Derive an expression for vector potential. 4  
(b) In the Bohr model of hydrogen atom the electron circulate around the nucleus in a path of radius  $5.1 \times 10^{-11}$  m at a frequency of  $6.8 \times 10^{15}$  hertz. Calculate magnetic dipole moment. 1
- VIII. Derive an expression for impedance for a LCR series circuit. When a.c. supply is applied to such a circuit, Also discuss resonance condition. 5

#### SECTION-C

- IX. Attempt any five parts :
- (a) Find the value of self-inductance of a solenoid of 100 turns of length 20 cm and radius 5 cm. 2
- (b) Give the quality factor (Q) of resonance circuit. 2
- (c) What are Ferrites? 2
- (d) What do you understand by Magnetic susceptibility and permeability? 2
- (e) Explain the Free and Bound current. 2
- (f) Give the physical significance of  $\vec{\nabla} \cdot \vec{B} = 0$ . 2
- (g) What is Lorentz force on charge moving parallel to magnetic field? 2