Exam. Code : 103202
Subject Code : 1265

B.A./B.Sc. 2nd Semester

PHYSICS

Paper-A (Relativity and Electromagnetism)

Time Allowed—Three Hours] [Maximum Marks—35

Note :—Attempt **FIVE** questions, selecting at least **ONE** question from each Section A, B, C and D. Fifth question may be attempted from any Section.

SECTION—A

1. What are basic postulates of Einstein's special theory of relativity ? Derive Lorentz space time transformation equations for two inertial frames. What happens for $v << c$? 7

2. What do you understand by relativistic Doppler effect ? Derive an expression for longitudinal and Transverse Doppler effect. 7

SECTION—B

3. (i) What is Lorentz Force ?

   (ii) What is Biot Savart's Law ? Derive an expression for the magnetic field at a point on the axis of a circular coil carrying current I. 1,6

4. (i) State and prove Ampere's circuital law of magnetic field and show that :

$$\vec{\nabla} \times \vec{B} = H_o \vec{J}.$$

(ii) A long straight wire carries a current of 2A. An electron travels with a velocity of 4×10^4 ms^{-1} parallel to the wire 0.1 m from it and in a direction opposite to the current. What force does the magnetic field of current exert on the moving electron ? 5,2

SECTION—C

5. Define the term impedance. Obtain its formula for an LCR (series) circuit. Find condition for resonance. Give one practical application of LCR circuit. 7

6. (i) What is self inductance ? Give its unit. Find the self inductance of a long solenoid.

(ii) Describe the physical significance of the displacement current and derive an expression for it. Write modified form of Ampere circuital law. 4,3

SECTION—D

7. (i) Define skin depth of a conductor. Show that it is a function of frequency of em wave. Explain why an em wave will not propagate into a conductor at high frequency.

(ii) Find the impedance offered by a dielectric medium to em waves. 4,3

8. (i) Show that average value of Poynting vector is given by :

$$S_{av} = \frac{1}{2} H_o^2 \times (\text{Real part of } \bar{z}_c) .$$

(ii) Calculate the coefficient of reflection and transmission of energy of the normal incident em waves on the surface having n (refractive index) = 1.7. 5,2