Exam. Code : 103202
Subject Code : 1337

B.A./B.Sc. 2ⁿᵈ Semester

PHYSICS

Paper—A

(Relativity and Electromagnetism)

Time Allowed—Three Hours]   [Maximum Marks—35

Note :—There are **FIVE** sections in total. Section A is compulsory. Attempt **ONE** question each from sections B, C, D and E.

SECTION—A

I.   (i)   Show that rest mass of photon is zero.

(ii)   Give the postulates of special theory of relativity.

(iii)   Is there a force exerted by a magnetic field on a stationary charge ? Explain.

(iv)   Which equation shows that isolated magnetic poles do not exist ?

(v)   The induced e.m.f. is sometimes called back e.m.f. why ?

(vi)   What is Poynting vector ? What are its units ?

(vii)   Why light waves travel through vacuum, whereas sound waves cannot ? $1 \times 7 = 7$

SECTION—B

II.   (a)   What do you understand by relativistic Doppler's effect ? Derive an expression for Longitudinal Doppler's effect.

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(b) Find the length of a metre stick moving length wise at a speed of 0.8 C, where C is velocity of light. 5,2

III. Derive the formula for relativistic variation of mass with velocity. Show that no material body can have a velocity equal to or greater than velocity of light.

7

SECTION—C

IV. What is Biot Savart law ? Derive an expression for the magnetic field $\vec{B}$ at a point on the axis of a circular coil carrying current. 7

V. What is vector potential ? Derive an expression for it. Show that divergence of vector potential is zero. 7

SECTION—D

VI. (a) Derive the differential form of Faraday's law of electromagnetic induction.

(b) Define self inductance. Give its SI units. 5,2

VII. Define the term impedance. Obtain its formula for an LCR circuit in series. 7

SECTION—E

VIII. Show that electromagnetic waves are transverse in nature. 7

IX. (a) Find the value of impedance of a dielectric to electromagnetic waves.

(b) Calculate the Poynting vector from a 100 watt lamp at a distance of 1 m from it. 5,2

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