PD-260

(522) M. Sc. PHYSICS (SECOND SEMESTER)

Examination, June-2021

Compulsory

Paper-III

[ELECTRODYNAMICS]

Time: Three Hours] [Maximum Marks: 80

[Minimum Marks: 29

Note: *Answer the questions from both the Sections as directed. The figures in the right-hand side margin indicate the marks.*

Section-A

1. Answer the following questions -- (1×10= 10 Marks)

a. Write the mathematical expression for the *conservation of charge*.

b. What do you mean by *Isotropic Dielectric* medium?

c. Write the Maxwell's equation which is derived using Faraday's and Lenz's laws.

d. Write the condition for which the reflected wave is in phase with the incident wave when **E** is perpendicular to the plane of incidence.

e. What do you mean by the term *waveguide*?

f. Write the *second postulate* of special theory of relativity.

g. Write Lorentz's transformation equations.

h. Write any two characteristics of electromagnetic potentials A and φ.

i. Write the advantages of Lorentz gauge.

j. What do you mean by Lienard-Wiechert potentials?

2. Answer the following questions -- (2×5= 10 Marks)

a. Write the Maxwell's equations in *Linear Isotropic Media*.

b. Write the *dynamic properties* of reflection and refraction.

c. Define the *reflection coefficient* R at the interface between two non-conducting media.

d. What do you mean by *differential operator*?

e. What is an *oscillating dipole*?

Section-B

Answer the following long answer type questions -- (15×4= 60 Marks)

3. Discuss the propagation of electromagnetic waves in conducting media and establish the relations for wave equation, phase velocity and refractive index.

Or

Discuss the propagation of electromagnetic waves in ionized gases and establish the relations for conductivity of ionized region and find the condition of wave propagation in the ionized media.

4. Deduce the Fresnel's equations for non-conducting media when incident wave is polarzed with its electric vector is normal to the plane of incidence.

Or

Explain the basic concepts of waveguides and briefly discuss Transverse Electric Mode and Transverse Magnetic Mode.

5. Explain the concept of four vectors. Discuss Lorentz transformation of space and time in four vector form.

Or

Express the electromagnetic potentials **A** and ϕ in terms of four vectors and obtain their transformation laws.

6. Discuss the Cerenkov radiation and show that the essential condition for the production of such radiation is

$$1 > \frac{1}{\beta^2 n^2}$$

Where n is the refractive index and $\beta = u^2/c^2$

Or

Establish the relation for the angular distribution of radiated power due to arbitrary accelerated charge and discuss the case when velocity and acceleration are perpendicular to each other.