

**5 SEM TDC PHY M 2**

**2018**

( November )

**PHYSICS**

( Major )

Course : 502

( **Electrodynamics** )

Full Marks : 60

Pass Marks : 24 / 18

Time : 3 hours

*The figures in the margin indicate full marks for the questions*

1. Choose the correct answer from the following : 1×6=6

(a) The refractive indices of glass and water are 1.54 and 1.33 respectively. The polarizing angle for a beam incident from water to glass is

- (i)  $33^\circ$
- (ii)  $40^\circ 52'$
- (iii)  $49^\circ 8'$
- (iv)  $57^\circ$

( Turn Over )

( 2 )

(b) Which of the following statements is wrong?

- (i) The electromagnetic waves travel with the same speed in all media.
- (ii) The speed of the electromagnetic waves is independent of the wavelength in non-dispersive medium.
- (iii) In the electromagnetic waves, the electric and magnetic vectors oscillate perpendicularly to the direction of propagation of waves.
- (iv) The electromagnetic waves are produced by accelerated charged particles.

(c) The radiation zone of an oscillating dipole is

- (i)  $r \gg c/\omega$
- (ii)  $r \gg \omega/c$
- (iii)  $\alpha = \beta$
- (iv)  $\beta \gg \alpha$

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(d) Which of the following statements is correct?

(i) Dimensions perpendicular to velocity of moving frame are contracted.

(ii) A moving clock runs fast.

(iii) In every closed system, the total relativistic energy and momentum are conserved.

(iv) All of the above

(e) In propagation of electromagnetic waves in a conducting medium, the skin depth depends on

(i) frequency

(ii) conductivity

(iii) dielectric properties of conductor

(iv) both frequency and conductivity



(f) In polarization for normal incidence, the sum of reflected coefficient and transmission coefficient is always equal to

(i) zero

(ii) 1

(iii) 2

(iv)  $\pi/2$

2. (a) What is displacement current? Explain Maxwell's postulates for displacement current. 1+4=5

(b) Discuss the propagation of plane electromagnetic wave in an isotropic dielectric medium and hence show that electric vector  $\vec{E}$ , magnetic vector  $\vec{H}$  and propagation vector  $\vec{K}$  are perpendicular to each other.

3. (a) Deduce an expression for magnetic scalar potential.

(b) Give the physical significance of Maxwell's fourth equation.

4. Derive the expressions for electromagnetic fields of an oscillating dipole. 6

Or

Show the complete pattern of electric and magnetic lines from an oscillating electric dipole. 6

5. (a) Explain Brewster's law on the basis of electromagnetic theory. 3

(b) A plane electromagnetic wave is incident obliquely at the boundary of two non-conducting media. Discuss the phenomena of reflection and refraction. 4

6. Show that the speed of electromagnetic wave in isotropic dielectric is less than the speed of electromagnetic wave in free space. 5

Or

Obtain boundary conditions satisfied by electromagnetic field vector  $\vec{E}$  on the plane interface between the media. 5

7. Discuss the phenomenon of polarization of electromagnetic wave. 5

8. (a) Explain the twin paradox phenomenon.
- (b) What are time dilation and improper length in relativistic mechanics?  $2+2=4$
9. (a) What is relativistic energy? Prove the relation  $E^2 - p^2 c^2 = m_0^2 c^4$ .
- (b) Find the relativistic mass of an electron moving with a speed of  $0.8c$ .

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