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SECTION 'C'  $4 \times 10 = 40$

Long Answer questions (Word limit 400-450 words.)

UNIT-I

Q. 1. Establish Maxwell's field equation for propagation of electromagnetic wave in a conduction media and show that the wave penetrate the conduction medium to the depth  $\delta$ .

OR

Obtain Poynting theorem for the conservation of energy in an electromagnetic field and discuss the physical meaning of each term in the resulting equation.

UNIT-II

Q. 2. Describe Fresnel's equation for propagation of light in non-conducting medium on the basis of electromagnetic theory.

OR

What is a wave guide? For a transverse electric wave perfectly propagating in a rectangular wave guide with perfectly conducting walls, find the cut off wave length.

UNIT-III

Q. 3. Express Maxwell's field equation in tensor form and there by define electromagnetic field tensor.

OR

What is the concept of Minkowski space and four vector. Give Lorentz transformation in four vector form.

UNIT-IV

Q. 4. What is retarded potential? Obtain Larmor's formula.

OR

Write notes on the following (any-2)

- (i) Cherenkov radiation
- (ii) Radiation pattern by an array
- (iii) Lorentz Gauge

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ROLL NO.....

**PHY. 203/21**  
**II SEMESTER EXAMINATION, 2021**  
**M.Sc. (PHYSICS)**  
**PAPER-III**  
**ELECTRODYNAMICS**

TIME: 3 HOURS

MAX.- 80

MIN.- 16

Note: The question paper consists of three sections A, B & C. All questions are compulsory.

Section A- Attempt all multiple choice questions.

Section B- Attempt one question from each unit.

Section C- Attempt one question from each unit.

SECTION 'A'  $2 \times 8 = 16$

MCQ (Multiple Choice Questions)

1. The term which was added by Maxwell to the Ampere's law for time varying field is -
 

(a) current	(b) displacement current
(c) resistance	(d) electro motive force
2. In free space, which parameter will be unity?
 

(a) permittivity	(b) Absolute permittivity
(c) relative permittivity	(d) permeability
3. In transverse electric waves, which of the following is true -
 

(a) E is parallel to H
(b) E is parallel to wave direction
(c) E is transverse to wave direction
(d) H is transverse to wave direction

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4. The intrinsic impedance of free space is -  
(a) 489 (b) 265  
(c) 192 (d) 377
5. Under Lorentz transformation which statement is false -  
(a)  $x^2 + y^2 + z^2 - c^2t^2$  is invariant  
(b) three dimensional volume element is invariant  
(c) four dimensional volume element is invariant  
(d) D'Alembertian operator is invariant
6. Select the true statement- Under Lorentz transformation-  
(a) Charge is invariant but charge density is variant  
(b) Charge and Charge density both are invariant  
(c) Charge and Charge density both are variant  
(d) Charge is variant but charge density is invariant
7. Lienard - Wiechart Potential are-  
(a) Scalar potential produced by static charge  
(b) Vector potential produced by a moving charge  
(c) Scalar potential produced by a moving charge  
(d) Scalar and Vector potential produced by a moving charge
8. Larmor's formula is -  
(a)  $P = \frac{1}{4\pi E_0} \frac{2q^2 a^2}{3c^3}$  (b)  $P = \frac{1}{4\pi E_0} \frac{2q^2 a^2}{3c^2}$   
(c)  $P = \frac{1}{4\pi E_0} \frac{2q^3 a^2}{3c^2}$  (d)  $P = \frac{1}{4\pi E_0} \frac{2q^2 a^3}{3c^2}$

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SECTION 'B' 4 × 6 = 24

Short Answer Type Questions (Word limit 200-250 words.)

**UNIT-I**

- Q. 1.** State Ampere's circuital law and discuss how it was modified to include displacement current.

**OR**

Discuss plane electromagnetic wave in free space.

**UNIT-II**

- Q. 2.** What is a wave guide? Discuss the propagation of electromagnetic wave along a hollow conduction infinite tube (cylindrical) filled with a dielectric.

**OR**

Determine the boundary conditions satisfied by B,H,E and D at the interface between two media of different permeability's and dielectric constants.

**UNIT-III**

- Q. 3.** Express Lorentz condition and equation of continuity in covariant form.

**OR**

What is a four vector? Obtain Lorentz transformations for components of current density.

**UNIT-IV**

- Q. 4.** Discuss electromagnetic scalar and vector potentials derive the solutions of scalar and vector potential in terms of charge and current distribution.

**OR**

What is the significance of retarded potential? Derive an expression for Lienard-Wiechert potential.s