BCG-003-1015026 Seat No. _____

B. Sc. (Sem. V) (CBCS) (W.E.F. 2016) Examination

August – 2021

Physics : P - 502

(Electrodynamics & Relativity)

(New Course)

Faculty Code : 003

Subject Code : 1015026

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instructions : (1) Symbols and notations have their usual meaning.

(2) Total marks of the question is indicated on the right side of the question.

(3) Attempt any five questions out of the following ten questions.

1   (A) Give answers to the following :   **4**

(1) Define : Faraday law.

(2) The flux rule for motional emf $\in = $ _____

(3) Give the equation of Poynting's vector in terms of $\vec{E}$ and $\vec{B}$

(4) $\vec{\nabla}.\vec{J} = $ _____ ?

(B) Give Maxwell's equations before Maxwell.   **2**

(C) Derive continuity equation.   **3**

(D) Explain energy stored in magnetic fields.   **5**

2   (A) Give answers to the following :   **4**

(1) What is formula for Ohm's law in electrodynamics ?

(2) Write the Unit of inductance.

(3) Write the integral form of the Ampere's law.

(4) A changing magnetic field induces an electric field (True/False)

(B) Explain three experiments of Faraday's law. **2**

(C) Write a note on the Maxwell's modification of **3**
Ampere's law.

(D) Explain inductance in detail. **5**

3 (A) Give answers to the following : **4**

    (1) Define : Transverse wave.

    (2) Define : Intensity.

    (3) Write an equation of the speed of wave propagating in string having tension T and linear density μ.

    (4) Write transmission amplitude A_T in terms of A_I.

(B) The intensity of sunlight hitting the earth is **2**
about 1300 W/m². If sunlight strikes a perfect absorber, what pressure does it extert? How about a perfect reflector ?

(C) Prove wave equation for $\vec{E}$ and $\vec{B}$ **3**

(D) Discuss the boundary condition for reflection and **5**
transmission of the electromagnetic waves.

4 (A) Give answers to the followings: **4**

    (1) Write the three dimensional form of wave equation for wave f travelling with speed v.

    (2) What is wave ?

    (3) The wavelength of visible blue light is $4.6 \times 10^{-7} m$. What is its frequency in vacuum ?

    (4) Write an equation to represent the wavelength λ of light waves in terms of wave number K.

(B) Show that the standing wave $f (z,t) = A$ sin (kz) cos **2**
(Kvt) satisfies the wave equation.

(C) Explain monochromatic plane wave. **3**

(D) Explain energy and momentum in electromagnetic **5**
waves.

5 (A) Give answer to the following : **4**

    (1) Write electric field in the form of vector and scalar potential.

(2) In electrostatics $\nabla \times E = 0$, is it true or false ?

(3) $\Box^2 \vec{A} = $ _____

(4) $\vec{\nabla} \times \vec{B} = $ _____.

(B) Explain the conclusion of gauge transformation. 2

(C) Explain Coulomb gauge. 3

(D) Explain retorted potentials. 5

6 (A) Give answer to the followings : 4

(1) The advance time ta = _____

(2) Write the equation to find the field $\vec{B}$ from $\vec{A}$ in context of electro dynamics.

(3) In magnetostatics, $\nabla . A = 0$. Do you agree ?

(4) The direction of a magnetic field of a point charge is always _____ to the electric field.

(B) $\vec{B} = \vec{\nabla} \times \vec{A}$ and $\vec{E} = -\vec{\nabla}v - \dfrac{\partial \vec{A}}{\partial t}$. Now find Gauss's law 2 and Ampere's law in terms of $\vec{A}$ and V.

(C) Explain : Gauge Transformation. 3

(D) Discuss in detail in Jefimenko's equation in context 5 of electrodynamics.

7 (A) Give answer to the followings : 4

(1) Explain static source do not radiate.

(2) According to Bio-Sasvert's law, magneto static field decreases according to the term $1/r^2$. It is true or false ?

(3) Give the equation for the Abraham Lorentz formula.

(4) Give the expression of Larmor formula.

(B) Draw physical dipole and perfect dipole. 2

(C) Explain the blueness of sky. 3

(D) Write a note on radiation reaction. 5

8 (A) Give answer to the following : 4

(1) The accelerated motion of charge gives rise to radiation. True or False.

(2) E and B are in phase, mutually perpendicular and transverse the ratio of their amplitude $\dfrac{E_0}{B_0} = $ _____

(3) Radiation reaction is due to the force of the charge on itself. The statement is true/false.

(4) The total power radiated over a sphere is independent of the _____ of the sphere.

(B) How does EM wave produced ? 2

(C) What is Radiation ? 3

(D) Write note on the total power radiated by point charge. 5

9 (A) Give answer to the followings : 4

(1) Equation $V_{AC} = V_{AB} + V_{AC}$ is called as Einstein's velocity addition rule (True/False)

(2) Write formula for speed of light in terms of permeability and permitivity of vacuum.

(3) According to time dilation, the moving clocks run _____.

(4) Mass is invariant and not conserved. (T/F)

(B) Write the equations of Lorentz transformation. 2

(C) Write a note on proper time and proper velocity. 3

(D) Derive and discuss in detail the Lorentz transformations for the moving bodies. 5

10 (A) Give answer to the followings : 4

(1) Dimensions of moving object perpendicular to motion are not construct (True/False)

(2) For which type of system the total relativistic energy and momentum are conserved ?

(3) The trajectory of a particle on a Minkowski diagram is called a _____.

(4) Moving objects are shortened. (True/False)

(B) A moon is travelling through the laboratory at three-fifths the speed of light. How long does it last ? 2

(C) Explain Lorentz contraction. 3

(D) Write note on – Relativistic Energy and Momentum. 5

_____