

B.Sc. Semester - 5 (Remedial) (CBCS) Examination**March/April-2024 (Old Course)****ELECTRODYNAMICS AND RELATIVITY (CORE)****Time: 2:30 Hours****Marks: 70****Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Que-1(A) Answer the following questions (any one) (07)
- (1) Discuss the Faraday's experiment and Faraday's law with derivation in detail.
 - (2) Explain: Newton's third law in electrodynamics.
- Que-1(B) Answer the following questions (any one) (04)
- (1) Derive the continuity equation.
 - (2) Explain the flux rule for motional emf.
- Que-1(C) Answer the following questions (any three) (03)
- (1) Define Poynting Vector.
 - (2) The continuity equation is, $\frac{\partial \rho}{\partial t} = \dots\dots\dots$
 - (3) The mathematical expression of conservation of charge can be described using Continuity Equation. True/False.
 - (4) Give SI unit of Charge.
 - (5) Give the SI unit of Current Density.
- Que-2(A) Answer the following questions (any one) (07)
- (1) Write a note on energy and momentum in electromagnetic waves.
 - (2) Write a note on polarization in electromagnetic waves.
- Que-2(B) Answer the following questions (any one) (04)
- (1) Explain monochromatic plane waves.
 - (2) Write a note on sinusoidal waves.
- Que-2(C) Answer the following questions (any three) (03)
- (1) Define Wave.
 - (2) Relation between wavelength λ and wave number k is given by $\lambda = \dots\dots\dots$
 - (3) Define Intensity.
 - (4) Mechanical wave requires medium to propagate. True/False.
 - (5) Traveling speed of electromagnetic waves in empty space is, $v = \dots\dots\dots$
- Que-3(A) Answer the following questions (any one) (07)
- (1) Explain retarded potential.
 - (2) Explain the Coulomb Gauge.
- Que-3(B) Answer the following questions (any one) (04)
- (1) Explain Lorentz Gauge.
 - (2) Explain Jefimenko's equation.
- Que-3(C) Answer the following questions (any three) (03)
- (1) $\square$ is known as momentum operator. [True/False]
 - (2) The curl of gradient of any scalar function is $\dots\dots\dots$
 - (3) According to Maxwell's equation $\nabla \times \mathbf{E} = \dots\dots\dots$
 - (4) $\mathbf{E} + \frac{\partial \mathbf{A}}{\partial t} = \dots\dots\dots$
 - (5) $\nabla \cdot \mathbf{B} = \dots\dots\dots$

- Que-4(A) Answer the following questions (any one) (07)
- (1) Write a note on Magnetic dipole radiation.
 - (2) Explain the reason behind the redness of the sunset and blueness of sky.
- Que-4(B) Answer the following questions (any one) (04)
- (1) Write a note on radiation from an arbitrary source in case of approximation $r' \ll r$.
 - (2) Explain radiation reaction.
- Que-4(C) Answer the following questions (any three) (03)
- (1) $P_{\text{electric}} / P_{\text{magnetic}} =$
 - (2) An electric dipole consists of two like charges. True/False
 - (3) The irreversible flow of energy away from the source is called
 - (4) When accelerate, their fields can transport energy irreversibly out to infinity.
 - (5) In the case of point charge, the radiated power increases as the particle velocity increases. True/False
- Que-5(A) Answer the following questions (any one) (07)
- (1) Explain proper time and proper velocity.
 - (2) Discuss: Relativistic Energy and Relativistic Momentum.
- Que-5(B) Answer the following questions (any one) (04)
- (1) Discuss the relativistic kinematics.
 - (2) Explain Galilean transformation.
- Que-5(C) Answer the following questions (any three) (03)
- (1) Write Einstein's postulates of special theory of relativity.
 - (2) In every closed system, the total relativistic energy and momentum are not conserved. True/False
 - (3) Moving clocks run
 - (4) Moving objects are shortened. True/False
 - (5) Write an equation for relativistic energy.
