

B.Sc. Semester - 5 (CBCS) Examination

July-2025 (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 in detail the conservation of angular momentum in electrodynamics.
 - 2) Write a note on Poynting's theorem.
- Que-1(B) Answer the following questions (Any One) (04)**
- 1) Explain the Maxwell's modification to the Ampere's law.
 - 2) Derive the continuity equation.
- Que-1(C) Answer the following questions (Any three) (03)**
- 1) Define Poynting Vector.
 - 2) Magnetic monopoles do not exist. [True/False]
 - 3) The mathematical expression of conservation of charge can be described using Continuity Equation. [True/False]
 - 4) What is the unit of Inductance?
 - 5) Give the SI unit of Current Density.
- Que-2(A) Answer the following questions (Any One) (07)**
- 1) Derive the classical wave equation.
 - 2) Write a note on polarization in electromagnetic waves.
- Que-2(B) Answer the following question (Any One) (04)**
- 1) Obtain the formula for radiation pressure when light falls on perfect absorber.
 - 2) Write a note on sinusoidal waves.
- Que-2(C) Answer the following questions (Any three) (03)**
- 1) Define Wave.
 - 2) The gamma rays have the highest wavelength among the electromagnetic spectrum. [True/False]
 - 3) The wavelength of ultraviolet waves is smaller than infrared waves. [True/False]
 - 4) Mechanical wave requires medium to propagate. [True/False]
 - 5) Relation between wavelength λ and wave number k is given by $\lambda = \dots\dots\dots$
- Que-3(A) Answer the following questions (Any One) (07)**
- 1) Write a note on Electric and Magnetic fields of moving charge with constant velocity.
 - 2) Derive Jefimenko's Equations.
- Que-3(B) Answer the following questions (Any One) (04)**
- 1) Explain Lorentz Gauge.
 - 2) Explain Scalar and Vector Potentials.
- Que-3(C) Answer the following questions (Any three) (03)**
- 1) ∇ is known as momentum operator. [True/False]
 - 2) The curl of gradient of any scalar function is $\dots\dots\dots$
 - 3) The direction of magnetic field of a moving point charge is always $\dots\dots\dots$ to the electric field.
 - 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 Lienard's generalization of Larmor formula.
- Que-4(B) Answer the following questions (Any One) (04)**
- 1) Discuss power radiated by a point charge.
 - 2) Derive Abraham-Lorentz formula for the radiation force.
- 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 electric charge accelerate, their fields can transport energy irreversibly out to infinity. [True/False]
 - 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: Lorentz transformation.
- Que-5(B) Answer the following questions (Any One) (04)**
- 1) Write a note on relativistic energy and momentum.
 - 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 faster. [True/False]
 - 4) Moving objects are shortened. [True/False]
 - 5) What do you mean by inertial reference frame?
