

B.Sc. Semester - 5 (CBCS) Examination**Oct/Nov. - 2018****ELECTRODYNAMICS AND RELATIVITY (CORE)****Time: 2:30 Hours****Marks: 70****Instructions:**

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

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- Q-1(A) Answer in detail: (any one) (07)
- (1) Explain mutual inductance and derive the Neumann formula for it.
 - (2) Describe – Poynting's theorem.
- Q-1(B) Answer the following: (any one) (04)
- (1) Describe Faraday's experiments and explain Faraday's law for electromagnetic induction.
 - (2) Derive the continuity equation.
- Q-1(C) Write a short answer to the following: (any three) (03)
- (1) Write Lorentz force law
 - (2) The current density ($\mathbf{J}$) is proportional to the force per unit current. – is it true or false?
 - (3) Eddy Currents are responsible for slowing down the swings of aluminium disc in the field region of magnet. – Do you agree with this?
 - (4) The unit of inductance is ____
 - (5) The pointing vector ($\mathbf{S}$) gives the value of energy flux density. – Is it true or false?
- Q-2(A) Answer in detail: (any one) (07)
- (1) Discuss boundary conditions for reflection and transmission of waves.
 - (2) Derive the classical wave equation.
- Q-2(B) Answer in brief for the following: (any one) (04)
- (1) Derive the wave equation for $\mathbf{E}$ and $\mathbf{B}$ in vacuum.
 - (2) Obtain the formula for radiation pressure when light Falls on the perfect absorber.
- Q-2(C) Write a short answer to the following: (any three) (03)
- (1) Define wave.
 - (2) Standing waves do not propagate. – Do you agree?
 - (3) Wave motion is possible in a string only when it is stretched. – is it true or false?
 - (4) Write a formula relating wavelength λ and wave number k .
 - (5) The gamma rays have highest wavelength among the electromagnetic spectrum. – is it true or false?
- Q-3(A) Write in detail: (any one) (07)
- (1) Explain in detail: Lienard-Wiechert potentials.
 - (2) Derive Jefimenko's equations for $\mathbf{E}$ and $\mathbf{B}$.
- Q-3(B) Answer the following: (any one) (04)
- (1) Write equations of $\mathbf{V}$ and $\mathbf{A}$ in terms of d'Alembertian operator.
 - (2) Explain : The Coulomb gauge.

- Q-3(C) Write a short answer to the following: (any three) (03)
- (1) Write formula for d'Alembertian operator
 - (2) In electrostatics, $\nabla \times \mathbf{E} = 0$. – Is it true or false?
 - (3) In magnetostatics, $\nabla \cdot \mathbf{A} = 0$ – Do you agree ?
 - (4) The direction of a magnetic field of a point charge is always _____ to the electric field.
 - (5) In case of a moving point charge, velocity field is responsible for the electromagnetic radiation. – is it true or false?
- Q-4(A) Write in detail: (any one) (07)
- (1) Explain magnetic dipole radiation and derive expression of $\mathbf{E}$ and $\mathbf{B}$.
 - (2) Discuss power radiated by a point charge and obtain Larmour formula.
- Q-4(B) Answer the following: (any one) (04)
- (1) Explain the blueness of sky and redness of sun-set.
 - (2) Discuss radiation reaction and derive Abraham Lorentz formula.
- Q-4(C) Write a short answer to the following: (any three) (03)
- (1) Define: radiation.
 - (2) Only accelerated charge or changing current can produce radiation. – Do you agree?
 - (3) According to Biot-Savart's law, magnetostatic fields decreases according to the term $1/r^2$. – is it true or false?
 - (4) In case of electromagnetic waves. The ratio $E_0/B_0 = ?$
 - (5) Which one is dominating – magnetic dipole radiation or electric dipole radiation?
- Q-5(A) Write in detail: (any one) (07)
- (1) Explain: the Lorentz transformations.
 - (2) Discuss: relativistic energy and momentum.
- Q-5(B) Answer the following: (any one) (04)
- (1) A Muon is traveling through the laboratory at three-fifths the speed of light. How long does it last? Lifetime of muon is 2 microsecond.
 - (2) Explain Lorentz contraction.
- Q-5(C) Write a short answer to the following: (any three) (03)
- (1) Define proper time
 - (2) What do you mean by an inertial reference frame?
 - (3) Write Einstein's velocity addition rule.
 - (4) According to relativity theory a moving clock run fast. – Do you agree?
 - (5) According to Lorentz contraction, the moving objects are shortened in all dimensions. – is it true or false?
