REV-01
MSP/33/38

2023/12

SET A

M.Sc. PHYSICS
FIRST SEMESTER
ELECTRODYNAMICS
MSP-104 IDMn
[USE OMR FOR OBJECTIVE PART]

Duration: 1:30 hrs. **Full Marks: 35**

(Objective)

Time: 15 mins. **Marks: 10**

Choose the correct answer from the following: ***IX10=10***

1. Which one of the following is not an example of electromagnetic wave?
   a. Radio Waves
   b. X-Rays
   c. Sound waves
   d. Microwaves

2. What is the SI Unit of electric flux?
   a. Nm^{-1}
   b. Nm^2C^{-1}
   c. $Nm^{-2}C^{-1}$
   d. Nm^2

3. Outside of a uniformly charged conducting hollow spherical shell, which of the following is true?
   a. $E \propto \frac{1}{r^2}$
   b. $E \propto \frac{1}{\lambda^3}$
   c. $E \propto \frac{1}{r}$
   d. $E \propto \frac{1}{\lambda}$

4. The work done by an electric field E on a charged particle q moving between two points depends on which of the following?
   a. Only on the path followed by the point
   b. Only on the location of the points
   c. On both the path followed by a point as the location of the points
   d. None of the above

5. Which of the following is the Poisson's equation?
   a. $\nabla^2 V = -\frac{\epsilon}{\rho}$
   b. $\nabla^2 V = \frac{\rho}{\epsilon}$
   c. $\nabla^2 V = 0$
   d. $\nabla^2 V = -\frac{\rho}{\epsilon}$

6. Magnetic flux will increase if the no. of magnetic field lines passing through a unit area?
   a. Decreases
   b. Remains constant
   c. Fluctuates
   d. Increases

7. $\nabla \times E = -\frac{\partial B}{\partial t}$ represent which law from the following option?

a. Geuss's Law
b. Faraday's law
c. Ampere's Law
d. None of the above

8. Lorentz force is given by which equation?

a. $F = q(E + v \times B)$
b. $E = q(F + v \times B)$
c. $F = q(v \times B)$
d. $F = (E + v \times B)$

9. Which of the following is a Maxwell's equation in free space?

a. $\nabla \times E = \frac{\partial B}{\partial t}$
b. $\nabla \times H = -\frac{\partial D}{\partial t}$
c. $\nabla . E = -\frac{\rho}{\epsilon}$
d. $\nabla \times E = -\frac{\partial B}{\partial t}$

10. Which of the following is an electromagnetic wave equation in free space in terms of B?

a. $\nabla^2 B = \frac{1}{c^2}\frac{\partial^2 B}{\partial t^2}$
b. $\nabla^2 E = \frac{1}{c^2}\frac{\partial^2 B}{\partial t^2}$
c. $\nabla^2 B = c^2\frac{\partial^2 B}{\partial t^2}$
d. $\nabla^2 B = \frac{1}{c}\frac{\partial^2 B}{\partial t^2}$

Descriptive

Time: 1 hr. 15 mins. Marks: 25

[Answer question no.1 & any two (2) from the rest]

1. Write down the Maxwell's equation in differential form. Derive the wave equation in vacuum in terms of magnetic field. 2+3=5

2. Find out the electric field for an infinitely large plane sheet with uniformly distriouted charges on its surface. 10

3. Applying Gauss's law of electrostatics, find out the electric field for a uniformly charged hollow spherical shell. 10

4. Define magnetic force and write down its properties. Derive the wave equation in vacuum in terms of electric field and show that the velocity of e.m. wave in free space is equivalent to the velocity of light. 4+3+3 =10

5. Describe the conservative nature of electrostatic field. Show that the closed integral of conservative electric field is zero 7+3=10