

**BACHELOR OF SCIENCE EXAMINATION, 2019**

**(3rd Year, 1st Semester)**

**MATHEMATICS(HONOURS)**

**Mathematical Physics and Relativity**

**Unit - 5.6(a)**

Time : Two hours

Full Marks : 50

Use a separate Answer-Script for each part.

**PART - I (25 marks)**

Answer *Q. No. 4* and any *two* from the rest.

1. (a) State Coulomb's law of Electrostatics. 2  
(b) Derive the differential form of Gauss law. 4  
(c) Find an expression for scalar potential and interpret physically. 5
2. (a) Define electric dipole. Find the electric field at a point P due to the presence of an electric dipole. 2+5  
(b) Define electric image. 4

(Turn over)

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3. (a) Derive the basic equation for magnetostatics. 6  
(b) Write Biot-Savart Law. 5
4. Define electric field at a point P(x) for a system of n point charges  $q_i$ ,  $i = 1, \dots, n$  placed at  $x_i$ ,  $i = 1, 2, \dots, n$ . 3

**PART - II (25 marks)**

Answer any *five* questions.

5. Derive General Lorentz Transformations.
6. Write the postulates of special theory of relativity. Show that proper time is invariant under Lorentz Transformation.
7. A circular ring moves parallel to its plane relative to an inertial frame. Show that the shape of the ring relative to S is an ellipse.
8. Write the Equation of Continuity in Covariant Form. Show that Equation of Continuity is invariant under Lorentz Transformation.

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9. Find relativistic kinetic energy. Derive classical limit of it.
10. Deduce relativistic law of addition of velocities. Find its classical form.
11. Show that it is impossible for a photon to transfer all its energy to a free electron.

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