Roll No. : .....

Total No. of Questions : **11**] [Total No. of Printed Pages : **3**

APF–2176

M.A./M.Sc. (Final) Examination, 2022

MATHEMATICS

Paper - Opt.-IX

(Relativity and Cosmology)

*Time : **3** Hours*] [*Maximum Marks : **100***

Section–A **(Marks : 2 × 10 = 20)**

Note :– Answer all *ten* questions (Answer limit **50** words). Each question carries **2** marks.

Section–B **(Marks : 4 × 5 = 20)**

Note :– Answer all *five* questions. Each question has internal choice (Answer limit **200** words). Each question carries **4** marks.

Section–C **(Marks : 20 × 3 = 60)**

Note :– Answer any *three* questions out of five (Answer limit **500** words). Each question carries **20** marks.

Section–A

1. (i) Define Time Dilation.

   (ii) State the conservation law of momentum.

(iii) Define principle of General Covariance.

(iv) Define Keplar's law.

(v) Define electromagnetic tensor.

(vi) Write the principle of relativity.

(vii) State the law of conservation of mass.

(viii) Define the relativistic differential equation for orbit of the planet.

(ix) Define the trace of Einstein tensor for perfect fluid.

(x) Define cosmological redshift.

Section–B

2. Derive the relativistic addition law of velocity.

Or

Derive the Lorentz-Fitzgerald contraction formula.

3. Establish the relationship between Relativistic Momentum and Energy.

Or

Derive the transformed form of momentum and energy.

4. Define Schwarzschild metric and also write its properties.

Or

Discuss the Einstein field equation for matter and empty space.

5. Define the energy momentum tensor. Also give a brief note on Newtonian fluids.

Or

Write the Schwarzschild interior metric and also give its boundary conditions.

6. Describe positively and negatively charged particles.

Or

Write the general properties of the energy momentum tensor.

Section–C

7. Prove that Maxwell's field on equations are invarient under Lorentz transformation.

Or

Derive the Reissner-Nordstrom metric for spherically charged particle from Eisntein's field equation together with Maxwell's equation.

8. Derive the special Lorentz transformation equations.

9. Derive the Lagrangian approach of general relativity.

10. Reduce the Einstein's field equations in Poisson equation.

11. Describe the three crucial tests in general relativity.