This question paper contains 4 printed pages]

1665

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

MATHEMATICS

Paper–VI

(Relativity)

Time Allowed : Three Hours

This question paper will be divided into ***three*** *sections.*

Section A

1. (*i*) Define Inertial and non-inertial frames.

(*ii*) Write Christoffel symbols of first kind.

(*iii*) What do you mean by four-dimensional space-time ?

(*iv*) Write the expression for energy-momentum formula for perfect fluid.

(*v*) Write the expression for Schwarzschild line-element.

(*vi*) Write the expression for Einstein's field equations.

(*vii*) Write *three* crucial tests in General relativity.

(*viii*) What do you mean by Gravitational red shift ?

(*ix*) Write any *two* physical properties of Einstein Universe.

(*x*) What do you mean by velocity of a particle in de-sitter universe ?

Section B

UNIT-I

2. Explain Lorentz-Fitzerald contraction formula.

3. Explain Relativistic Composition of parallel velocities.

UNIT-II

4. Write notes on principle of General Covariance.

5. Explain four-dimensional space-time.

UNIT-III

6. Discuss Schwarzschild interior solution for gravitational field.

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7. Derive Isotropic form of Schwarzschild exterior line-element.

UNIT-IV

8. Explain the advance of perihelion of mercury.

9. Explain Gravitational Red Shift.

UNIT-V

10. Discuss the motion of test particle in the de-sitter universe.

11. Explain red shift in the spectral line on distant galaxies.

Section C

12. Derive the Lorentz transformation equations.

13. If ρ be the co-ordinate density of matter then prove that energy momentum tensor is given by :

$$T^{ij} = \rho \frac{dx^i}{dt} \frac{dx^j}{dt}$$

14. Discuss the Doppler effect in Einstein and de-sitter universe.

15. Write short notes on :

(a) Principle of equivalence

(b) Michelson-Morley experiment

(c) Wayl hypothesis

(d) Birkhoits theorem.

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