M.Sc. (Mathematics) (New CBCS Pattern) Semester-III

PSCMTH14B - Elective Optional Paper : General Relativity-I

P. Pages : 2 **GUG/S/25/13759**

Time : Three Hours * 2 2 3 4 * Max. Marks : 100

Notes : 1. Solve all **five** questions.
2. Each question carries equal marks.

UNIT – I

1. a) State & prove the Bianchi Identity. **10**

b) Prove that $\Gamma^{m}_{mn} = \left(\ln\sqrt{g}\right)_{,n}$ OR $\left(\ln\sqrt{-g}\right)_{,n}$ for $g < 0$ **10**

OR

c) Show that the divergence of the Einstein tensor G_{ij} or G^{i}_{j} Vanish. **10**

d) Define geodesic. Obtain the differential equation of geodesic in a given space. **10**

UNIT – II

2. a) Obtain the energy momentum tensor for perfect fluid. **10**

b) Show that the Poisson's equation can be recovered to field equation of general relativity. **10**

OR

c) Write a note on principle of equivalence. **10**

d) Explain principle of covariance. **10**

UNIT – III

3. a) Derive the equation for planetary orbit in the general theory of relativity. **10**

b) Explain the gravitational red shift in the spectral line. **10**

OR

c) Derive Schwarzschild exterior solution. **10**

d) Discuss Schwarzschild singularity. **10**

UNIT – IV

4. a) Derive the linearized field equations for non-empty space. **10**

b) Derive the static spherically symmetric solutions of linearized field equations. **10**

OR

c) Explain structure of linearized equation. **10**

d) Derive Weyl solution. **10**

5. a) Prove that $[ij,k]+[ik,i]=\frac{\partial g_{ik}}{\partial x^{j}}$ **5**

b) Define **5**
   i) Inertial mass
   ii) Gravitational mass.

c) State one of the classical test of general relativity & explain it. **5**

d) Discuss **5**
   i) Associated Weyl solution
   ii) Lorentz – gauge

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