



- Notes : 1. Solve all the **five** questions.
2. All questions carry equal marks.

UNIT - I

1. a) Discuss the necessary & sufficient condition that the first covariant derivative of covariant vector be symmetric is that the vector be gradient. **10**
b) Obtain the Riemannian Christoffel symbol R_{ijk}^a . **10**

OR

- c) Obtain the differential equation of geodesic in a given space. **10**
d) Show that the divergence of Einstein's tensor vanishes. **10**

UNIT - II

2. a) Obtain the energy momentum tensor in Galilean coordinate system. **10**
b) Prove that the Poisson's equation can be recovered to field equation of general theory of relativity. **10**

OR

- c) Discuss the principle of covariance. **10**
d) Obtain the energy momentum tensor for non interactive coherent cartesian matter. **10**

UNIT - III

3. a) State & prove the Birkhoff's theorem. **10**
b) Derive the equation of planetary orbit in the general theory of relativity. **10**

OR

- c) Discuss the Schwarzschild's singularity. **10**
d) Explain the gravitational red shift in the spectral line. **10**

UNIT - IV

4. a) Derive the gravitational field equations for nonempty space. **10**
b) Obtain the Weyl's solution of linearized field equation. **10**

OR

- c) Obtain the Schwarzschild's interior solution for the spherically symmetric distribution of matter with constant density. **10**
d) Derive the linearized field equation. **10**

5. a) Show that $\left\{ \begin{smallmatrix} i \\ ij \end{smallmatrix} \right\} = \frac{\partial}{\partial x^j} \log \sqrt{g}$ **5**
b) State the Mach principle. **5**
c) Discuss the advance of perihelion of a planet. **5**
d) Explain: **5**
i) Lorenz-gauge ii) Associated Weyl solution
