

M.Sc.(Mathematics) (New CBCS Pattern) Semester - III  
**PSCMTHT14-2 / PSCMTH14B-Optional Paper : General Relativity-I**

P. Pages : 2

Time : Three Hours



**GUG/S/23/13759**

Max. Marks : 100

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

**UNIT – I**

1. a) Prove that  $\text{div } T^r = \frac{1}{\sqrt{g}} \left( T^r \sqrt{g} \right)_{,r}$ . **10**
- b) Define geodesic & prove that geodesics are auto-parallel curves. **10**

**OR**

- c) Prove that  $R_{prmn;t} + R_{prnt;m} + R_{prtm;n} = 0$ . **10**
- d) Prove that the divergence of the Einstein tensor vanishes. **10**

**UNIT – II**

2. a) Explain Mach Principle. **10**
- b) Obtain  $T^{4n}_{,n}$  for incoherent matter distribution  $T^{mn}$ . **10**

**OR**

- c) Obtain the relation between  $g_{44}$  &  $V$ . **10**
- d) Show that the Poisson equation is recovered from the field equations of general relativity. **10**

**UNIT – III**

3. a) Obtain  $R_{33}$  &  $R_{44}$  for the line element  $ds^2 = -e^A dr^2 - r^2(d\theta^2 + \sin^2 \theta d\phi^2) + e^B dt^2$  where  $A$  &  $B$  are functions of  $r$  alone. **10**
- b) Obtain an equation to the planetary orbits. **10**

**OR**

- c) Obtain Schwarzschild solution in isotropic coordinates. **10**
- d) Explain Bending of light rays. **10**

## UNIT – IV

4. a) Obtain the derivation of linearized field equations. 10  
b) Obtain the Weyl solution. 10

**OR**

- c) Obtain the spherically symmetric solutions of linearized field equations. 10  
d) Explain associated Weyl solution. 10
5. a) Show that any tensor of the second order (covariant) may be expressed as the sum of a symmetric tensor & a Skew symmetric tensor. 5  
b) Explain inertial mass & gravitational mass. 5  
c) Define Schwarzschild singularity. 5  
d) Write short note on gravitational waves. 5

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