

M.Sc. - II (Mathematics) CBCS Pattern Semester-III
PSCMTH14B - General Relativity-I (Optional)

P. Pages : 2

Time : Three Hours



GUG/W/23/13759

Max. Marks : 100

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

UNIT – I

1. a) Prove that the divergence of Einstein tensor vanishes i.e. $G_{n;m}^m = 0$. **10**
- b) State and prove the Bianchi identity. **10**

OR

- c) Prove that $\frac{\delta T^r}{\delta u}$ is contravariant vector. **10**
- d) Derive the equation of geodesic deviation. **10**

UNIT – II

2. a) Obtain the energy momentum tensor for electromagnetic field. **10**
- b) Show that the Poisson's equation can be recovered to field equation of general relativity. **10**

OR

- c) Obtain the relation between g_{44} and v . **10**
- d) Obtain the Einstein's field equations from action principle. **10**

UNIT – III

3. a) Derive the mathematical formulation of bending of light rays. **10**
- b) Compute all the non-vanishing Christoffel Symbols of the metric $ds^2 = -e^A dr^2 - r^2(d\theta^2 + \sin^2\theta d\phi^2) + e^B dt^2$ **10**

OR

- c) Obtain the equation for planetary motion. **10**
- d) Obtain the Schwarzschild solution in isotropic coordinates. **10**

UNIT – IV

4. a) Derive the linearized field equation. 10
b) Derive the line element for the interior Schwarzschild solution. 10

OR

- c) Derive Weyl solution. 10
d) Derive the spherically symmetric solutions of the linearized field equations. 10
5. a) Prove that $g_{mn,r} = [mr, n] + [nr, m]$ 5
b) Explain the principle of covariance. 5
c) Write short note on advance of perihelion of mercury. 5
d) Discuss: 5
i) Associated Weyl Solution.
ii) Lorenz-gauge.
