M.Sc. (Mathematics) (NEW CBCS Pattern) Sem-III

PSCMTH14 (B) / MSCMTH14 (B) - Optional Paper : General Relativity-I

P. Pages : 2 **GUG/W/22/13759**

Time : Three Hours * 3 4 6 3 * Max. Marks : 100

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

UNIT – I

1. a) Let A^r, B^r be arbitrary contravariant vectors & $a_{rs} A^r B^s$ be an invariant. Then show that a_{rs} are the components of a covariant tensor of the 2nd order. **10**

b) Prove that $\left| \overline{} \right.^{m}_{mn} = \left(\log \sqrt{g}\right), n$ **10**

OR

c) Prove that $\frac{\delta T^r}{\delta u}$ is a contravariant vector. **10**

d) State & prove the Bianchi identity. **10**

UNIT – II

2. a) Explain the principle of equivalence. **10**

b) Obtain T^{mn} for incoherent matter distribution. **10**

OR

c) Obtain energy momentum tensor for electromagnetic field. **10**

d) Obtain the relation between g_{44} & V. **10**

UNIT – III

3. a) Obtain R_{11} & R_{22} for the line element **10**

$$ds^2 = -e^A dr^2 - r^2\left(d\theta^2 + \sin^2\theta d\phi^2\right) + e^B dt^2$$

where A & B are functions of r alone.

b) Obtain the equation for planetary motion. **10**

OR

c) Explain Advance of perihelion of Mercury with mathematical formulation. **10**

d) Using mathematical formulation explain gravitational red shift. **10**

UNIT – IV

4. a) Obtain the derivation of linearization of field equations. **10**

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

OR

c) Obtain the weyl solution. **10**

d) Explain Associated weyl solution. **10**

5. a) Show that covariant derivatives of 9mm, 9^{mm} & δ_n^m vanish. **5**

b) Show that $R^m{}_n = -k\left(T_n^m - \frac{1}{2}T\delta_n^m\right)$ **5**

c) Write the classical tests of general relativity. **5**

d) Write a short note on Gravitation waves. **5**

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