2018

MATHEMATICS

MAT304

OPTIONAL I (GENERAL RELATIVITY AND COSMOLOGY-I)

Full Marks: 80

Time: 3 hours

1. **Attempt (any five) from the following:** (12 X 5 = 60)

(a) Derive the Einstein's field equation

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = kT_{\mu\nu}$$,when the symbols have their usual meaning.

(b) What are the three crucial test in Relativity? Explain about the advance of perihelions of the planet.

(c) Derive the relativistic differential equation of the orbit of the planet.

(d) Explain about the linearization of field equations.

(e) Derive the Einstein's equations for Degenerate matrices.

(f) Obtain the Schwarzschild's interior solution for gravitational field of a single mass continually at rest at the origin.

(g) Explain the Newton's theory of gravitation describing gravitational attraction forces between two particles.

2. **Answer the following questions** (5X4=20)

(a) Write a note on Eddington's form of Schwarzschild solution.

Or

Write a note on Order m^2 Equation.

(b) Discuss the Principle of covariance and the principle of equivalence of general theory of relativity

Or

Write a short history of development of General Theory of Relativity.

(c) Calculate the Schwarzschild time and the proper time elapsed when a particle moves once round a circular path of size $r = a$.

What happen when $r \rightarrow 3GM$?

Or

(d) Find value of g for the line element

$$ds^2 = dt^2 - R^2(t)\left\{\frac{dr^2}{1-Kr^2} + r^2 d\theta^2 + r^2 \sin^2\theta d\varphi^2\right\}$$

(e) Prove that $KM=c^2m$, where K is constant of gravitation, M is mass of

attracting particle, m the constant occurring in Schwarzschild solution.

Or

Show that the deflection of light rays as calculated on the assumptions of Einstein's theory of gravitation is double that might have predicted on Newton's theory.

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