Q1. Solve the equation for which the Lie derivative of the metric tensor is zero, i.e., \( L_\xi g = 0 \).
   Solve the resulting equation in plane polar coordinates.
Q2. A metric admits a time-like Killing’s vector \( \partial / \partial t \). What conservation law this vector admits?
Q3. Write down the geodesic equations. Solve them for the surface of a unit sphere with metric \((1, \sin^2 \theta)\).
Q4. Find an expression for the Riemann Christoffel curvature tensor \( R^a_{bcd} \). Using the metric tensor, write it in a totally covariant form \( R_{abcd} \). Using this covariant form, give all the symmetry properties of this tensor.
Q5. Give the expression for Einstein tensor. From this tensor construct vacuum Einstein field equations.
Q6. In a static, spherically symmetric metric express all the independent Einstein field equations in terms of the metric tensor. Without solving these equations, give solutions of these equations in vacuum.