Course objectives:
The aim of the course is to have a comprehensive physical idea and mathematical understanding of General theory of Relativity and its applications in fields like Cosmology and Astrophysics.

UNIT 1: Introduction

UNIT 2: Tensor Analysis
Riemannian space, Curvilinear coordinates, Tensors, Affine connection, Covariant derivative, Geodesics, Riemann-Christoffel curvature tensor, Bianchi identities, Ricci Tensor, Curvature Scalar.

UNIT 3: Einstein Field Equations

UNIT 4: Schwartzchild Solution and Tests of General Theory of Relativity
Centrally symmetric Gravitational Field, Static spherically symmetric space-time, Schwartzchild Solutions, Radial Freefall, Lighcones.

UNIT 5: Black Holes and Cosmology
Relativistic Stellar star structure, Gravitational Collapse, Black Holes.

Text Books:
Reference Books:
1. Landau & Lifshitz, *Classical Field Theory*, University Science Books, 1E, 2004

Course Outcomes:
After the completion of the course student is expected to:

CO1: Use differential geometry to describe the properties of a curved space and demonstrate specialised analytical skills and techniques necessary to carry out the study of special theory of relativity using tensor calculus.

CO2: Understand Einstein's field equations, account for the physical interpretation of its components, and prove that Newton's theory of gravity is recovered in the non-relativistic limit.

CO3: Study of solution of Einstein field equation in the case of static, spherically symmetric gravitational field. Study of particle trajectories and tests of GTR.

CO4: Apply the mathematical and physical ideas of the theory of general relativity for the study of various systems in astrophysics and cosmology

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