General Relativity and Cosmology - I
Graduate School - First Semester

Course outline

0. **Historical Perspective**
1. **Special Relativity**
   - Theoretical and Observational formulation
   - Lorentz Transformations
   - Relativistic Mechanics
   - Classical field theory (symmetries and conservation laws)
2. **Mathematical Formulation**
   - Equivalence principle
   - Manifolds, Tensors, affine connection, Metric
   - Derivative operator, Riemann curvature, Geodesics
   - Killing Vectors
3. **Einstein Field Equations**
   - Einstein Equations
   - Lagrangian formulation of GR
   - Symmetries and conservation laws in GR
   - Exact Solutions
     [Schwarzschild (exterior solution), Tolman (interior solution), FRW Model, Vaidya solution]
4. **Applications of General Relativity**
   - Solar System tests (bending of light, mercury perihelion advance, geodetic pricession)
   - Gravitational Waves

References:

1. L. D. Landau & E. M. Lifshitz: Classical Theory of Fields,
2. S. Weinberg: General Relativity and Cosmology,
3. R. d'Inverno: General Relativity,
4. B. F. Shutz: First Course in General Relativity,
5. J. L. Synge: General Theory of Relativity,
6. J. Hartle: General Relativity,
7. Notes on GR which are recent and follow modern notation:
   [S. Caroll: General Relativity (available online)]