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Nota di contenuto	Cover; Preface; Contents; 1 Introduction; 1.1 Relativity as a coordinate symmetry; 1.1.1 Coordinate transformations; 1.1.2 The principle of relativity; 1.2 Einstein and relativity; 1.2.1 The new kinematics; 1.2.2 GR as a field theory of gravitation; Review questions; 2 Special Relativity: The New Kinematics; 2.1 Einstein's two postulates and Lorentz transformation; 2.1.1 Relativity of simultaneity and the new conception of time; 2.1.2 Coordinate-dependent time leads to Lorentz transformation; 2.2 Physics implications of Lorentz transformation; 2.2.1 Time dilation and length contraction 2.2.2 The invariant interval and proper time2.3 Two counterintuitive scenarios as paradoxes; Review questions; 3 Special Relativity: Flat Spacetime; 3.1 Geometric formulation of relativity; 3.2 Tensors in special relativity; 3.2.1 Generalized coordinates: bases and the metric; 3.2.2 Velocity and momentum 4-vectors; 3.2.3 Electromagnetic field 4-tensor; 3.2.4 The energy-momentum-stress 4-tensor for a field

system; 3.3 The spacetime diagram; 3.3.1 Invariant regions and causal structure; 3.3.2 Lorentz transformation in the spacetime diagram; Review questions
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Review questions5 General Relativity as a Geometric Theory of Gravity; 5.1 Metric description of a curved manifold; 5.1.1 Gaussian coordinates and the metric tensor; 5.1.2 The geodesic equation; 5.1.3 Local Euclidean frames and the flatness theorem; 5.2 From the equivalence principle to a metric theory of gravity; 5.2.1 Curved spacetime as gravitational field; 5.2.2 GR as a field theory of gravitation; 5.3 Geodesic equation as the GR equation of motion; 5.3.1 The Newtonian limit; Review questions; 6 Einstein Equation and its Spherical Solution; 6.1 Curvature: a short introduction
6.2 Tidal gravity and spacetime curvature6.2.1 Tidal forces-a qualitative discussion; 6.2.2 Deviation equations and tidal gravity; 6.3 The GR field equation; 6.3.1 Einstein curvature tensor; 6.3.2 Einstein field equation; 6.3.3 Gravitational waves; 6.4 Geodesics in Schwarzschild spacetime; 6.4.1 The geometry of a spherically symmetric spacetime; 6.4.2 Curved spacetime and deflection of light; 6.4.3 Precession of Mercury's orbit; Review questions; 7 Black Holes; 7.1 Schwarzschild black holes; 7.1.1 Time measurements around a black hole; 7.1.2 Causal structure of the Schwarzschild surface
7.1.3 Binding energy to a black hole can be extremely large

Sommario/riassunto

This advanced undergraduate text introduces Einstein's general theory of relativity. The topics covered include geometric formulation of special relativity, the principle of equivalence, Einstein's field equation and its spherical-symmetric solution, as well as cosmology. An emphasis is placed on physical examples and simple applications without the full tensor apparatus. It begins by examining the physics of the equivalence principle and looks at how it inspiredEinstein's idea of curved spacetime as the gravitational field. At a more mathematically accessible level, it provides a metric descr