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Nota di contenuto	Introduction.-Notational Conventions -- Functional Analytic -- On Schatten-von Neumann Classes and Trace Class -- Pointwise Estimates for Integral Kernels -- Dirac-Type -- Derivation of the Trace Formula -- The Trace Class Result -- Derivation of the Trace Formula -- Diagonal Estimates -- The Case $n = 3$ -- The Index Theorem and Some Consequences -- Perturbation Theory for the Helmholtz Equation -- The Proof of Theorem 10.2: The Smooth Case -- The Proof of Theorem 10.2: The General Case -- A Particular Class of Non-Fredholm Operators $L$ and Their Generalized Witten Index -- A: Construction of the Euclidean Dirac Algebra -- B: A Counterexample to [22, Lemma 5] -- References -- Index.
Sommario/riassunto	These lecture notes aim at providing a purely analytical and accessible proof of the Callias index formula. In various branches of mathematics (particularly, linear and nonlinear partial differential operators, singular integral operators, etc.) and theoretical physics (e.g., nonrelativistic and relativistic quantum mechanics, condensed matter physics, and quantum field theory), there is much interest in computing Fredholm

indices of certain linear partial differential operators. In the late 1970's, Constantine Callias found a formula for the Fredholm index of a particular first-order differential operator (intimately connected to a supersymmetric Dirac-type operator) additively perturbed by a potential, shedding additional light on the Fedosov-Hörmander Index Theorem. As a byproduct of our proof we also offer a glimpse at special non-Fredholm situations employing a generalized Witten index.

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