

PHY 551: Quantum Mechanics I

Fall 2026

Instructor: Professor V.P. NAIR

Office: Room J-309 B, Marshak

Office hours: Wednesdays 2:00 PM to 4:00 PM

E-mail: vpnair@ccny.cuny.edu

Website: <https://nair.ccny.cuny.edu>

Class Schedule: 2:00 to 3:40 PM, Tuesdays & Thursdays

Room Marshak 417N

Text (recommended): Mark Beck, *Quantum Mechanics: Theory and Experiment*
Oxford University Press (2012)

Main resource: My lecture notes posted on Brightspace

Other recommended books:

Griffiths, D. J., *Introduction to Quantum Mechanics*, Second Edition, Pearson Prentice Hall

Eisberg, R. and Resnick, R., *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, Second Edition, John Wiley and Sons

Catalogue description of the course

Introductory material: 2-slit experiment, matter waves and addition of amplitudes, superposition principle; Uncertainty principle, properties of matter waves: Boundary conditions and energy level quantization and Schrödinger interpretation-wave equation, application to one dimensional problems, barrier penetration, Bloch states in solids and how bands form in solids; The universality of the Harmonic potential-Simple Harmonic oscillator and applications; One electron atoms, spin, transition rates; Identical particles and quantum statistics; Beyond the Schrödinger equation: Variational methods and WKB.

Prereq.: MATH 39100 and MATH 39200; Pre- or coreq.: PHYS 35100, PHYS 35400 (required for Physics majors). 4 hr./wk.; 4 cr.

Detailed description of topics specific to this term

Difficulties with classical physics; Matter waves; Mathematical introduction (Vector spaces; Fourier series; Cauchy-Schwarz inequality; L²-functions; Diagonalization of matrices and operators; Unitary and hermitian operators; Dirac delta function; postulates of QM; Schrödinger equation; Particles in one dimensions; operators as infinite-

dimensional matrices; Linear harmonic oscillator, operator method and differential equation; Free particles; piecewise constant potentials, tunneling; uncertainty principle; conservation of probability; Spherical coordinates; general theory of angular momentum; addition of angular momentum; Central potentials; Legendre polynomials; spherical harmonics; Hydrogen atom; spin and magnetic moment of electron; beginnings of many-particle QM.

Variations

I will follow a slightly different sequence starting with the physics which led to quantum mechanics, followed by a mathematical introduction. A set of lecture notes has been posted on the course page on Brightspace, they are also accessible from my webpage, at <https://nair.ccny.cuny.edu/551.html>

Grading

There will be two midterm examinations and a final examination. They will contribute to your final grade with weights of approximately 20%, 20% and 40%, respectively. These will be *closed book* exams, but I will give you a formula sheet with all the formulae which I consider will be useful for the exam.

Homework

There will be homework assignments, approximately one set for each week. They will be given out in class, and will also be listed on my website. These will be graded, and they do contribute to your final grade with a weight of 20%. It is very important (*for you*) that you do these problems. It has almost always been true that students who do not work out the problems find the exams difficult and end up getting a low grade for the course.

Attendance

Regular attendance is very important. There will be variations in my lectures compared to the book, for this reason, *attendance is important and you should keep good class notes*.

If you are absent for an exam, your grade for that exam will be zero. *There will be no make-up exams, except in dire medical emergencies, supported by a doctor's certificate.*