



QUANTUM MECHANICS I

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TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Must have done the sophomore course on quantum physics and applications where Schrodinger equation, wavefunction and expectation values are taught.

INTENDED AUDIENCE : BTech Engineering Physics, B Tech Electrical Eng, MSc Physics, MSc – 5 year integrated Chemistry

COURSE OUTLINE :

This course is a first level course in the Dirac's bra(ket) notation which will set foundation to take up advanced level courses

ABOUT INSTRUCTOR :

My field of research is mathematical physics. I have been working on knot invariants from Chern-Simons theory and topological strings.

COURSE PLAN :

- Week 1:** Introduction to Quantum Mechanics-I, Introduction to Quantum Mechanics-II, Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator-I, Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator-II
- Week 2:** Bound States-I, Bound States-II, Conditions and Solutions for One Dimensional Bound States - I, Conditions and Solutions for One Dimensional Bound States - II
- Week 3:** Linear Vector Space (LVS) - I, Linear Vector Space (LVS) - II, Linear Vector Space (LVS) - III, Basis for Operators and States in LVS - I
- Week 4:** Function Spaces - I, Function Spaces - II, Postulates of Quantum Mechanics - I, Postulates of Quantum Mechanics – II
- Week 5:** Classical Vs Quantum Mechanics - I, Classical Vs Quantum Mechanics - II, Compatible Vs Incompatible Observables - I, Compatible Vs Incompatible Observables - II
- Week 6:** Schrodinger and Heisenberg Pictures - I, Schrodinger and Heisenberg Pictures - II, Solutions to Other Coupled Potential Energies-I, Solutions to Other Coupled Potential Energies-II
- Week 7:** Hydrogen Atom Wave Functions, Angular Momentum Operators, Identical Particles-I, Hydrogen Atom Wave Functions, Angular Momentum Operators, Identical Particles-II, Identical Particles, Quantum Computer-I, Identical Particles, Quantum Computer-II
- Week 8:** Harmonic Oscillator -I, Harmonic Oscillator -II, Ladder Operators -I, Ladder Operators -II
- Week 9:** Stern-Gerlach Experiment-I, Stern-Gerlach Experiment-II, Oscillator Algebra Applications-I
- Week 10:** Angular Momentum-1 -I, Angular Momentum-1 -II, Rotations Groups -I, Rotations Groups -II
- Week 11:** Addition of Angular Momentum-I, Addition of Angular Momentum-II, Clebsch-Gordan Coefficient -I, Clebsch-Gordan Coefficient -II
- Week 12:** Clebsch-Gordan Coefficient -III, Tensor Operators & Wigner-Eckart Theorem-I, Tensor Operators & Wigner-Eckart Theorem-II, Tensor Operators & Wigner-Eckart Theorem-III.