PHYS 2210 Quantum Physics I Fall 2023

COURSE SCHEDULE (Tentative)

Time: 10:00 AM – 11:50 AM

Week	Tuesday	Friday
1	8/29 **Class 1: Math background I** Chapter 1.1, 1.4, Appendix B Introduction to quantum physics Complex variables Euler equation Differential equations	9/01 **Class 2: Math background II** Chapter 1.1 Partial differential equations Maxwell wave equations EM in cavity
2	9/05 Labor Day (9/4)	9/08 **Class 3: Wave nature of light** Chapter 1.2, 1.5, 1.6 Interference by light: Young double slit experiment X-ray diffraction from crystals **Homework 1 due 10am**
3	9/12 **Class 4: Particle nature of light** Chapter 1.3, 1.4 Photoelectric effect Compton scattering	9/15 **Class 5: Wave nature of matter** Chapter 2.1, 2.2 de Broglie wavelength Atom interference from double slit Atom diffraction from single slit Diffraction envelope **Homework 2 due 10am**

Week	Tuesday	Friday
4	9/19 **Class 6. Schrodinger wave equation** Chapter 2.3, 2.4 Uncertainty in position and momentum Electron diffraction from crystal Schrodinger wave equation Free particle solutions Probability interpretation Normalization of wave functions Probability flux	9/22 **Class 7: Wave packets** Chapter 2.6, 2.7 Gaussian wave packets Phase and group velocities Homework 3 due 10am
5	9/26 **Class 8: Expectation values** Chapter 2.8, 2.9 Quantum operators Expectation values Heisenberg uncertainty principle Ehrenfest's theorems	9/29 **Class 9: Particle in a box** Chapter 3.1, 3.2, 3.3 Time independent Schrodinger equation Wave functions and energy in a box Discrete energy states Homework 4 due 10am
6	10/03 **Class 10: Functional vector space** Chapter 3.3, 3.4 Mixed states and time dependent solutions Functional vector space Orthonormal conditions	10/06 **Class 11: Exam 1**
7	10/10 **Class 12: Energy eigenvalue problems** Chapter 3.4 Position and momentum operators Eigenvalue equations Energy eigenvalues	10/13 **Class 13: Simple harmonic oscillators** Chapter 4.3 Eigenfunctions and eigenenergies Hermite polynomials Homework 5 due 10am.

Week	Tuesday	Friday
8	10/17 **Class 14: Finite potential wells** Chapter 4.1, 4.2 Finite wells Boundaries matching First derivative matching Bound state solutions	10/20 **Class 15: Scattering from stepped potentials** Chapter 4.6 Traveling waves Probability currents Waves at stepped surfaces Reflection and transmission coefficients Homework 6 due 10am
9	10/24 **Class 16: Quantum tunneling** Chapter 4.7 Penetration of wavefunctions Escape traveling wavefunctions Transmission probability	10/27 **Class 17: Quantum postulates** Chapter 5.1, 5.2 Basic principles of quantum physics Operators Measurements and associated operators Eigenvalue problems Mixed states Probability of single measurement Commutators Homework 7 due 10am
10	10/31 **Class 18: Commutation relationships** Chapter 5.3, 5.4, 5.5 Commutation relationships Commuting observables Uncertainty relationships Time evolution of expectation values Hermitian operators	11/03 **Class 19: 3D problems** Chapter 6.1, 6.2 Cartesian vs spherical coordinate systems Separation of variables 3D infinite square well and harmonic oscillator 3D central field problems Homework 8 due 10am

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11	11/07 **Class 20: Exam 2**	11/10 **Class 21: Angular momentum** Chapter 6.1, 6.2 Angular momentum operators Polar coordinates Azimuthal angular momentum operator Eigenvalues of azimuthal angular momentum operator
12	11/14 **Class 22: Spherical harmonics** Chapter 6.2 Eigenvalue problem of L^2 Spherical harmonics Matrix representation	11/17 **Class 23. Hydrogen atom** Chapter 6.3 Central field problems Hydrogen atom Associated Laguerre polynomials Quantization of energy levels Homework 9 due 10am
13	11/21 **Class 24: Zeeman effect** Chapter 6.4 Classical magnetic moment Relationship with angular momentum Hamiltonian in external magnetic field Energy splitting and removal of degeneracies	11/24 No Class (Thanksgiving break 22nd – 24th)

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14	11/28 **Class 25: Intrinsic spins** Chapter 6.5 Stern-Gerlach experiment Half integer spin Spin operators The need of a generalized state function Homework 10 due 10am	12/01 **Class 26: More on quantum mechanics** Chapter: 'class notes' Spin-orbit interactions Qubit and entanglement Dirac equation and spin Quantization of fields Homework 11 due 10am
15	12/05 **Class 27: Review**	12/08 (last class) **Class 28: Exam 3**
16	12/12	12/15

Additional Academic Integrity Course Policy and Penalty Information

Here are some examples of what is considered “cheating” and “not cheating” in PHYS 1200. This is not intended to be a comprehensive list. If you are unsure about something, ask your lab instructor or lecturer.

Not cheating:

Most learning is done through discussion with your peers and instructors. It is encouraged.
Students are expected to actively participate in a collaborative group when working on the in-class activity. Discussion with peers or instructors is encouraged.
Discussion with peers or instructors on homework is encouraged.

Cheating:

Each student must turn in her/his own activity write-up. No student will be allowed to submit an activity in the name of any other student. The same policy applies to homework and in-class assignments. If you are caught copying or handing in work that is not your own, you will receive a non-droppable zero for that assignment and will be warned that this is not acceptable behavior. If unacceptable behavior persists after warning, it may result in an F for the course and a letter to the Dean of Students.
Collaboration (giving or taking information) or copying of any sort or using any aid that is not allowed during an exam is cheating. It will result in immediate failure and a letter to the Dean of Students.
Altering a returned exam and asking for a re-grade is cheating.

If you become aware of another student cheating on an exam or in any other aspect of the course, it is your responsibility and also in your best interests to inform the professor so that appropriate action may be taken. The reputation of Rensselaer as a premiere institute of research and learning rests on the integrity of its students, faculty, and staff.

If you have any question concerning this policy before submitting an assignment, please ask for clari6fication.