PHYS 2210 Quantum Physics I Spring 2020

COURSE SCHEDULE

Time: 10am – 11:50am

Week	Tuesday	Friday
1	1/14 **Class 1: Math background I** Chapter 1.1, 1.4, Appendix B Introduction to quantum physics Complex variables Euler equation Differential equations	1/17 **Class 2: Math background II** Chapter 1.1 Partial differential equations Maxwell wave equations EM in cavity
2	1/21 **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**	1/24 **Class 4: Particle nature of light** Chapter 1.3, 1.4 Photoelectric effect Compton scattering
3	1/28 **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**	1/31 **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

Week	Tuesday	Friday
4	2/4 **Class 7: Class 6: Wave packets** Chapter 2.6, 2.7 Gaussian wave packets Phase and group velocities	2/7 **Class 8: Expectation values** Chapter 2.8, 2.9 Quantum operators Expectation values Heisenberg uncertainty principle Ehrenfest's theorems Homework 3 due 10am
5	2/11 **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	2/14 **Class 10: Functional vector space** Chapter 3.3, 3.4 Mixed states and time dependent solutions Functional vector space Orthonormal conditions Homework 4 due 10am
6	2/18 President's day on Monday	2/21 **Class 12: Energy eigenvalue problems** Chapter 3.4 Position and momentum operators Eigenvalue equations Energy eigenvalues Homework 5 due 10am.
7	2/25 **Class 13: Simple harmonic oscillators** Chapter 4.3 Eigenfunctions and eigenenergies Hermite polynomials	2/28 **Class 14: Finite potential wells** Chapter 4.1, 4.2 Finite wells Boundaries matching First derivative matching Bound state solutions

Week	Tuesday	Friday
8	**3/3** **Class 15: Scattering from stepped potentials** Chapter 4.6 Traveling waves Probability currents Waves at stepped surfaces Reflection and transmission coefficients	3/6 **Exam 1** Homework 6 due 10am
9	3/10 Week of Spring break	
10	3/17 Classes Cancelled due to Covid-19	3/20
11	3/24 **Class 16: Quantum tunneling** Chapter 4.7 Penetration of wavefunctions Escape traveling wavefunctions Transmission probability **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	3/27 **Class 18: Commutation relationships** Chapter 5.3, 5.4, 5.5 Commutation relationships Commuting observables Uncertainty relationships Time evolution of expectation values Hermitian operators Homework 7 due 10am

Week	Tuesday	Friday
12	3/31 **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	4/3 **NOTE: Lecture & "Take home" Exam Today** **Class 21: Angular momentum** Chapter 6.1, 6.2 Angular momentum operators Polar coordinates Azimuthal angular momentum operator Eigenvalues of azimuthal angular momentum operator **Class 20: "Take home" Exam 2**
13	4/7 **Class 22: Spherical harmonics** Chapter 6.2 Eigenvalue problem of L^2 Spherical harmonics Matrix representation	4/10 **Class 23. Hydrogen atom** Chapter 6.3 Central field problems Hydrogen atom Associated Laguerre polynomials Quantization of energy levels Homework 9 due 10am

Week	Tuesday	Friday
14	4/14 **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	4/17 **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
15	4/21 **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	4/24 **Class 27: Review**
16	4/28 (last class) **Class 28: Exam 3**	
17		