

COURSE SCHEDULE

Time: 10am – 11:50am

Week	Tuesday	Friday
1	<p>1/14</p> <p><b>Class 1: Math background I</b></p> <p>Chapter 1.1, 1.4, Appendix B</p> <p>Introduction to quantum physics</p> <p>Complex variables</p> <p>Euler equation</p> <p>Differential equations</p>	<p>1/17</p> <p><b>Class 2: Math background II</b></p> <p>Chapter 1.1</p> <p>Partial differential equations</p> <p>Maxwell wave equations</p> <p>EM in cavity</p>
2	<p>1/21</p> <p><b>Class 3: Wave nature of light</b></p> <p>Chapter 1.2, 1.5, 1.6</p> <p>Interference by light:</p> <p>Young double slit experiment</p> <p>X-ray diffraction from crystals</p> <p><b>Homework 1 due 10am</b></p>	<p>1/24</p> <p><b>Class 4: Particle nature of light</b></p> <p>Chapter 1.3, 1.4</p> <p>Photoelectric effect</p> <p>Compton scattering</p>
3	<p>1/28</p> <p><b>Class 5: Wave nature of matter</b></p> <p>Chapter 2.1, 2.2</p> <p>de Broglie wavelength</p> <p>Atom interference from double slit</p> <p>Atom diffraction from single slit</p> <p>Diffraction envelope</p> <p><b>Homework 2 due 10am</b></p>	<p>1/31</p> <p><b>Class 6. Schrodinger wave equation</b></p> <p>Chapter 2.3, 2.4</p> <p>Uncertainty in position and momentum</p> <p>Electron diffraction from crystal</p> <p>Schrodinger wave equation</p> <p>Free particle solutions</p> <p>Probability interpretation</p> <p>Normalization of wave functions</p> <p>Probability flux</p>

Week	Tuesday	Friday
4	<p>2/4</p> <p><b>Class 7: Class 6: Wave packets</b></p> <p>Chapter 2.6, 2.7</p> <p>Gaussian wave packets</p> <p>Phase and group velocities</p> <p>Homework 3 due 10am</p>	<p>2/7</p> <p><b>Class 8: Expectation values</b></p> <p>Chapter 2.8, 2.9</p> <p>Quantum operators</p> <p>Expectation values</p> <p>Heisenberg uncertainty principle</p> <p>Ehrenfest's theorems</p>
5	<p>2/11</p> <p><b>Class 9: Particle in a box</b></p> <p>Chapter 3.1, 3.2, 3.3</p> <p>Time independent Schrodinger equation</p> <p>Wave functions and energy in a box</p> <p>Discrete energy states</p> <p>Homework 4 due 10am</p>	<p>2/14</p> <p><b>Class 10: Functional vector space</b></p> <p>Chapter 3.3, 3.4</p> <p>Mixed states and time dependent solutions</p> <p>Functional vector space</p> <p>Orthonormal conditions</p>
6	<p>2/18</p>	<p>2/21</p> <p><b>Class 11. Exam 1.</b></p>
7	<p>2/25</p> <p><b>Class 12: Energy eigenvalue problems</b></p> <p>Chapter 3.4</p> <p>Position and momentum operators</p> <p>Eigenvalue equations</p> <p>Energy eigenvalues</p>	<p>2/28</p> <p><b>Class 13: Simple harmonic oscillators</b></p> <p>Chapter 4.3</p> <p>Eigenfunctions and eigenenergies</p> <p>Hermite polynomials</p> <p>Homework 5 due 10am.</p>

Week	Tuesday	Friday
8	<b>3/3</b> <b>Class 14: Finite potential wells</b> Chapter 4.1, 4.2 Finite wells Boundaries matching First derivative matching Bound state solutions	3/6 <b>Class 15: Scattering from stepped potentials</b> Chapter 4.6 Traveling waves Probability currents Waves at stepped surfaces Reflection and transmission coefficients  Homework 6 due 10am
9	3/10 Week of Spring break	
10	3/17 <b>Class 16: Quantum tunneling</b> Chapter 4.7 Penetration of wavefunctions Escape traveling wavefunctions Transmission probability	3/20 <b>Class 17: Quantum postulates</b> 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
11	3/24 <b>Class 18: Commutation relationships</b> Chapter 5.3, 5.4, 5.5 Commutation relationships Commuting observables Uncertainty relationships	3/27 <b>Class 19: 3D problems</b> Chapter 6.1, 6.2 Cartesian vs spherical coordinate systems Separation of variables

	<p>Time evolution of expectation values</p> <p>Hermitian operators</p>	<p>3D infinite square well and harmonic oscillator</p> <p>3D central field problems</p> <p>Homework 8 due 10am</p>
12	<p>3/31</p> <p>Class 20: Exam 2.</p>	<p>4/3</p> <p><b>Class 21: Angular momentum</b></p> <p>Chapter 6.1, 6.2</p> <p>Angular momentum operators</p> <p>Polar coordinates</p> <p>Azimuthal angular momentum operator</p> <p>Eigenvalues of azimuthal angular momentum operator</p>
13	<p>4/7</p> <p><b>Class 22: Spherical harmonics</b></p> <p>Chapter 6.2</p> <p>Eigenvalue problem of <math>L^2</math></p> <p>Spherical harmonics</p> <p>Matrix representation</p>	<p>4/10</p> <p><b>Class 23. Hydrogen atom</b></p> <p>Chapter 6.3</p> <p>Central field problems</p> <p>Hydrogen atom</p> <p>Associated Laguerre polynomials</p> <p>Quantization of energy levels</p> <p>Homework 9 due 10am</p>

Week	Tuesday	Friday
14	<p>4/14</p> <p><b>Class 24: Zeeman effect</b></p> <p>Chapter 6.4</p> <p>Classical magnetic moment</p> <p>Relationship with angular momentum</p> <p>Hamiltonian in external magnetic field</p> <p>Energy splitting and removal of degeneracies</p>	<p>4/17</p> <p><b>Class 25: Intrinsic spins</b></p> <p>Chapter 6.5</p> <p>Stern-Gerlach experiment</p> <p>Half integer spin</p> <p>Spin operators</p> <p>The need of a generalized state function</p> <p>Homework 10 due 10am</p>
15	<p>4/21</p> <p><b>Class 26: More on quantum mechanics</b></p> <p>Chapter: class notes</p> <p>Spin-orbit interactions</p> <p>Qubit and entanglement</p> <p>Dirac equation and spin</p> <p>Quantization of fields</p> <p>Homework 11 due 10am</p>	<p>4/24</p> <p><b>Class 27: Review</b></p>
16	<p>4/28 (last class)</p> <p><b>Class 28: Exam 3</b></p>	
17		