NAU NORTHERN ARIZONA UNIVERSITY

Course Title: PHY 471 Quantum Mechanics
Term: Fall 2022
Instructor: TBA
Course Credit: 3
Mode of Instruction: Online

Course Description:

This course includes wave mechanics, Schrodinger's equation, barrier problems, harmonic oscillator, hydrogen atom and matrix methods. It provides a basis for further study of quantum mechanics. Content will also include: Review of the Schrodinger equation, operators, eigenfunctions, compatible observables, infinite well in one and three dimensions, degeneracy; Fourier methods and momentum space; Hermiticity; scalar products of wave functions, completeness relations, matrix mechanics; harmonic oscillator in one and three dimensions; sudden approximation; central potentials, quantisation of angular momentum, separation of radial and anqular variables, spherical harmonics, hydroqen atom, spin.

Course Prerequisites:

PHY 301 Methods Of Analytical Physics

PHY 321 Mechanics I

Learning Outcomes:

By the end of the course, the student should be able to:

A. Apply principles of quantum mechanics to calculate observables on known wave functions;

B. Solve time-dependent and time-independent Schrödinger equation for simple potentials;

C. Apply the variational method, time-independent perturbation theory and time-dependent perturbation theory to solve simple problems;

D. Describe the structure of the hydrogen atom and show an understanding of quantisation of angular momentum;

E. Apply techniques such as Fourier methods and ladder operators for selected problems in quantum mechanics.

F. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations.

Course Material:

David J. Griffiths, ***Introduction to Quantum Mechanics***, 2th, Pearson, 2005.

Evaluation:

- Lab reports [40%]
- Mid-term Exam [25%]
- Final Exam [35%]

Description of the Evaluation tasks:

Assignment/ Essay/ ... : During the term, students will be required to finish several evaluation tasks within due date. All the tasks are linked with specific course topics/outcomes and will adequately assess students' competence and learning outcomes. Students are encouraged to meet with instructor about these tasks at any point.

Mid-term/ Final Exams/ Quiz/... : There may be periodic quizzes given at the beginning of lecture sessions; the feedback from these quizzes will monitor the progress of the learners and help to set learning priorities. There will be mid-term exam/ final exam for the course. They are the basic criteria for the evaluation of students' learning outcomes and final grade.

Grading Policy:

Students are supposed to finish each online lecture. Prior to each class, students should finish the required readings. During the class time, students are encouraged to make use of all relevant online course resources and communicate with the instructor. Students' grades are accumulated based on the cumulative evaluations.

Students' letter grade will be assigned according to the following scale:

A+ 90-100	A 85-89	A- 80-84
B+ 77-79	B 73-76	B- 70-72
C+ 67-69	C 63-66	C- 60-62
D+ 57-59	D 53-56	D- 50-52
F < 50		

Academic Integrity:

Students must strictly adhere to the university's academic integrity rule; and all essays, exams and any other form of academic assignments must adhere to these rules. Any form of plagiarism, cheating, or misappropriation of materials will be considered a violation of academic integrity and will be punishable by the university.

Withdrawal from the Course(s):

Students will be able to apply for a transfer or withdrawal within 3 days of the starting date of the course. If a withdrawal is applied for within 3 working days, the tuition fee will be fully refunded. After 3 days, the tuition fee will not be refunded. If a withdrawal is applied for in the first two weeks, it will be recorded as W (Withdraw) on the course transcript. After this initial two-week period, the class will be recorded as F (Fail).

Tentative Schedule:

Week 1	
1	The Wave Function
2	The Statistical Interpretation
3	Probability
4	Normalization
5	Momentum **Lab report#1**
Week 2	
6	Time-Independence Schrödinger Equation
7	Stationary State
8	Formalism
9	Hilbert Space
10	Observables **Lab report#2**
Week 3	
11	Quantum Mechanics in Three Dimensions
12	The Hydrogen Atom
13	**Mid-term Exam**
14	Identical Particles
15	Two-Particle Systems **Lab report#3**
Week 4	
16	Time-Independent Perturbation Theory
17	Nondegenerate Perturbation Theory
18	The Fine Structure of Hydrogen
19	The Variational Principle
20	The Hydrogen Molecule Ion **Lab report#4**
Week 5	

21	The WKB Approximation
22	Scattering
23	Afterword
24	The Quantum Zeno Paradox
25	**Final Exam**