Course Description:
This course is intended to be a follow-on course to Quantum Mechanics I, which covered most of the basic topics in quantum mechanics, including perturbation theory, operator techniques, matrices, and the addition of angular momentum. These techniques will be applied to investigate a variety of more advanced subjects, including mixed states, the quantization of the electromagnetic field, the interaction of light with matter, second quantization formalism, and the Dirac theory.
In addition to covering these more advanced topics, the course will also review some of the topics covered in Quantum Mechanics I like Hydrogen Atom and Simple Harmonic Oscillator.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact Hours
1- The operators in Quantum Physics and expectation values a) Creation and annihilation operators b)The harmonic oscillator in terms of operators c) Wave function of ground and excited state of harmonic oscillator d) Time development of system using operators. e) The interaction of electrons with electromagnetic fields f) Zeeman's effect in the case of strong and weak magnetic fields.	3	6
2- Matrices in Quantum Physics a) Total angular momentum with matrices b) Orbital angular momentum with matrices c) Spin angular momentum with matrices d) Pauli's matrices	3	6
3- Approximation methods	1	2
4- Time independent perturbation method a) First order perturbation method and its application	2	4
5- Second order perturbation method and its application a) iteration perturbation method in iterative levels and its application	3	6
6- a) The variation method. b) The WKB approximation method.	2	4

The primary objective of this course is to develop familiarity with the *physical concepts* and facility with the *mathematical methods* of quantum mechanics. A secondary, but still very important objective is to cultivate your skills at formulating and solving physics problems. A subsidiary objective is to encourage the development of self-discipline and work habits that are useful both in academic course work and in the real world.

Course Goal

By the end of this course, you will be able to interpret and analyze a wide range of quantum mechanical systems using both exact analytic techniques and various approximation methods. This course is a continuation of *8.05 Quantum Mechanics II*, and will introduce some of the important model systems studied in contemporary physics, including two-dimensional electron systems, the fine structure of Hydrogen, lasers, and particle scattering.

Course Description

8.06 is the third course in the three-sequence physics undergraduate Quantum Mechanics curriculum. By the end of this course, you will be able to interpret and analyze a wide range of quantum mechanical systems using both exact analytic techniques and various approximation methods. This course will introduce some of the important model systems studied in contemporary physics, including two-dimensional electron systems, the fine structure of Hydrogen, lasers, and particle scattering.

Course description:
This course is intended to be a follow-on course to Quantum Mechanics I, which covered most of the basic topics in quantum mechanics, including perturbation theory, operator techniques, and the addition of angular momentum. These techniques will be applied to investigate a variety of more advanced subjects, including mixed states, the quantization of the electromagnetic field, the interaction of light with matter, entanglement, second quantization formalism, the Dirac theory, and anti-particles.
In addition to covering these more advanced topics, the course will also review some of the topics covered in Quantum Mechanics I.

Suggested Guidelines for Learning Outcome Verb, Assessment, and Teaching

NQF Learning Domains	Suggested Verbs
Knowledge	list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write

Cognitive Skills	estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise
Interpersonal Skills & Responsibility	demonstrate, judge, choose, illustrate, modify, show, use, appraise, evaluate, justify, analyze, question, and write
Communication, Information Technology, Numerical	demonstrate, calculate, illustrate, interpret, research, question, operate, appraise, evaluate, assess, and criticize
Psychomotor	demonstrate, show, illustrate, perform, dramatize, employ, manipulate, operate, prepare, produce, draw, diagram, examine, construct, assemble, experiment, and reconstruct

Suggested ***verbs not to use*** when writing measurable and assessable learning outcomes are as follows:

Consider	Maximize	Continue	Review	Ensure	Enlarge	Understand
Maintain	Reflect	Examine	Strengthen	Explore	Encourage	Deepen

Some of these verbs can be used if tied to specific actions or quantification.

Suggested assessment methods and teaching strategies are:

According to research and best practices, multiple and continuous assessment methods are required to verify student learning. Current trends incorporate a wide range of rubric assessment tools; including web-based student performance systems that apply rubrics, benchmarks, KPIs, and analysis. Rubrics are especially helpful for qualitative evaluation. Differentiated assessment strategies include: exams, portfolios, long and short essays, log books, analytical reports, individual and group presentations, posters, journals, case studies, lab manuals, video analysis, group reports, lab reports, debates, speeches, learning logs, peer evaluations, self-evaluations, videos, graphs, dramatic performances, tables, demonstrations, graphic organizers, discussion forums, interviews, learning contracts, antidotal notes, artwork, KWL charts, and concept mapping.

Differentiated teaching strategies should be selected to align with the curriculum taught, the needs of students, and the intended learning outcomes. Teaching methods include: lecture, debate, small group work, whole group and small group discussion, research activities, lab demonstrations, projects, debates, role playing, case studies, guest speakers, memorization, humor, individual presentation, brainstorming, and a wide variety of hands-on student learning activities.