

PHY 401– Quantum Mechanics Syllabus

Credit

3 semester hours

Prerequisites

PHY 301 or Instructor's Consent

Course Description

Schrodinger wave mechanics including application to atomic structure. An oral presentation on a relevant topic, selected in consultation with the instructor, will be made by each student.

Rationale for Course

In general, the study of physics gives students an in-depth understanding of the fundamental principles that govern the physical world around us, and a set of cognitive and technical skills which include thinking analytically, defining and solving problems, and collecting and analyzing and interpreting data. Quantum mechanics has played an essential role in the development of much of today's modern technology. This course provides students an exposure to the rigor and beauty of modern physics developments and analysis using quantum mechanics and is an advanced investigation of the basic principles of quantum mechanics, applying them principally to atomic structure.

Learning Objectives and Quality Enhancement Plan

After successful completion of this course students will become proficient in the analysis of simple quantum systems, understand the limitations of the Bohr model of the hydrogen atom, become proficient in deriving the solution to the Schrödinger wave equation for the hydrogen atom, and understand the interactions of atoms in molecular systems from a quantized angular momentum viewpoint.

This section of PHY 401 also includes an information literacy emphasis as part of U Research, Mississippi College's Quality Enhancement Plan (QEP). Through the oral presentation component of the course, the following student learning objectives (SLO's) will be addressed:

- SLO 4a: Apply new and prior information to the planning and creation of a product or performance.
- SLO 4b: Communicate the product or performance effectively and clearly to others.
- SLO 5a: Acknowledge sources and use information following the convention of a particular discipline.

Course Outline

- The Wave Function
- The Time-Independent Schrodinger Equation
- Quantum Mechanics in Three Dimensions
- Identical Particles
- Time-Independent Perturbation Theory

Method of Instruction

Class will consist primarily of presenting fundamental physics concepts and working problems. Key points will be highlighted by the choice of problems, and these points will be discussed in the context of the problem.

Required Text

Introduction to Quantum Mechanics, 2nd Edition, by David J. Griffiths

Academic Integrity

Mississippi College students are expected to be scrupulously honest. Dishonesty, such as cheating or plagiarism, or furnishing false information, including forgery, alteration or misuse of University documents, records or identification, will be regarded as a serious offense subject to severe penalty, including, but not limited to, loss of credit and possible dismissal. See the *Mississippi College Student Handbook* or University Policy 2.19 for specific information regarding penalties associated with dishonest behavior at Mississippi College. Copies of the *Mississippi College Student Handbook* are available in the Office of the Vice President for Enrollment Management and Student Affairs, Nelson 313. Copies of University policies are available on the Mississippi College web site.

Attendance Policy

Class attendance and participation is an essential part of a university education, and students are expected to attend and participate regularly and punctually in all classes and laboratories. The responsibility for any work missed as the result of an absence rests entirely with the student. Cumulative absences and nonparticipation may result in a lowered grade or loss of credit for the course. Tardiness is also subject to penalty, as is any failure to complete required class work on time. A student will receive a grade of F immediately upon accumulating the following number of absences, whether excused or unexcused:

- 12 in semester classes meeting three times per week
- 8 in semester classes meeting two times per week

If a student misses more than the number of class periods specified in university policy and believes that there are reasonable explanations for the absences, he/she may appeal the absences to the Dean of the School of Science and Mathematics.

Grading

The final average will be computed as follows: 55% will be from lecture tests, 10% from homework, 15% from class presentation, and 20% from the final exam. The final exam is comprehensive. Grading for the course will follow a 10 point scale:

Grade	Final Average
A	90–100
B	80–89
C	70–79
D	60–69
F	0–59

Makeup Tests

Makeup tests will be given only under the following circumstances:

- Consent of the instructor has been obtained prior to the test.
- An excused absence is obtained from a doctor or the Vice-President for Academic Affairs.

Oral Presentation

Four-weeks prior to the end of the semester, students will select a topic related to the field of Quantum Mechanics that they would like to research further. The topic must be approved by the instructor. At the end of the semester (prior to the final exam), students will deliver a minimum 15-minute oral power point

presentation to the class, followed by a 5 minute Q&A session. Presentations must include a minimum of 5 references, and these references must be cited in the presentation. Specific requirements of the presentation and proper techniques on reference citation will be discussed in class. For additional information on how the presentation will be graded, refer to the PHY 401 Quantum Mechanics Presentation Grading Rubric.

Dropping the Course

Refer to the Mississippi College Academic Calendar for the final drop date for the course. Drops after this date will only be permitted for extreme circumstances and will require approval from the course instructor, department chair, Dean of the School of Science and Mathematics, and the Vice-President for Academic Affairs.

Early Alert System

Mississippi College has adopted the practice of finding students early in the semester who may be exhibiting behaviors that could ultimately have a negative impact on their academic progress. These behaviors are often called “red flag” behaviors and include, but are not limited to, excessive absences, poor test grades, and lack of class participation or evidence of non-engagement. Identifying these behaviors early gives the instructor the opportunity to raise the “red flag” on behalf of a particular student so that the student can take the appropriate action to redirect his/her progress. The system alerts the student, the student’s advisor, and the Office of Student Success.

These messages are intended to help a student recognize an area of concern and to encourage him/her to make some choices to improve the situation. When a student receives an Early Alert message, the student should quickly make an appointment to talk with his/her professor about the situation. Also, students can make full use of the Office of Student Success to set academic goals and connect to campus resources.

Students with Disabilities

In order for a student to receive disability accommodations under Section 504 of the Americans with Disabilities Act, he or she must schedule an individual meeting with the Director of Student Counseling Services immediately upon recognition of their disability (if their disability is known they must come in before the semester begins or make an appointment immediately upon receipt of their syllabi for the new semester). The student must bring with them written documentation from a medical physician and/or licensed clinician that verifies their disability. If the student has received prior accommodations, they must bring written documentation of those accommodations (example Individualized Education Plan from the school system). Documentation must be current (within 3 years).

The student must meet with SCS face-to face and also attend two (2) additional follow up meetings (one mid semester before or after midterm examinations and the last one at the end of the semester). Please note that the student may also schedule additional meetings as needed for support through SCS as they work with their professor throughout the semester. Note: Students must come in each semester to complete their Individualized Accommodation Plan (example: MC student completes fall semester IAP plan and even if student is a continuing student for the spring semester they must come in again to complete their spring semester IAP plan).

Student Counseling Services is located on the 4th floor of Alumni Hall) or they may be contacted via email at mbryant@mc.edu . You may also reach them by phone at 601-925-7790. Dr. Morgan Bryant is director of MC Student Counseling Services.