

PHYS 530A: QUANTUM MECHANICS II

SYLLABUS (2014 Spring)

Department of Physics, Southern Illinois University–Carbondale

Last updated: January 13, 2014

1 General information:

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Web-page: <http://www.physics.siu.edu/~shajesh>

Class meetings: TR 9:35-10:50AM, in Neckers 410.

Office hours: MWF 12:00-1:00PM, TR 11:00AM-12:30PM.

2 Prerequisites:

Should be familiar with the contents of an undergraduate level course on Quantum mechanics, an equivalent of PHYS-430 Quantum Mechanics-I. Familiarity with the following topics will be assumed: complex variables, partial differential equations.

3 Course description

We shall introduce the measurement algebra in quantum mechanics in the context of Stern-Gerlach experiment. Harmonic oscillator will be treated completely. Generators of infinitesimal Galilean transformations, including spin, will be introduced, and the Hamilton's equations of motion will be derived. Angular momentum will be covered in detail, and the rotation transformation function for an arbitrary spin will be derived. Addition of angular momentum will be discussed and hydrogen atom states will be built out of addition of two "angular momentum". Zeeman effect and Stark effect will be discussed. In the following semester we will discuss perturbation theory, scattering theory, and Dirac equation.

References

1. *Quantum Mechanics: Symbolism of Atomic Measurements*, by J. Schwinger, edited by B.-G. Englert. (Assigned textbook.)
2. *Introduction to Quantum Mechanics*, lecture notes of K. A. Milton, available at <http://www.nhn.ou.edu/~milton/p3803-12.html> and <http://www.nhn.ou.edu/~milton/p4803-12.html>.
3. Lecture notes on Quantum Mechanics (Fall 2013), available at <http://www.physics.siu.edu/~shajesh/tc/201308-SIU-P530B/>.
4. *Quantum Mechanics*, by L. I. Schiff.
5. *Principles of Quantum Mechanics*, by R. Shankar.
6. *Quantum Mechanics*, by E. Merzbacher.
7. *Modern Quantum Mechanics*, by J. J. Sakurai.
8. *Quantum Mechanics*, by C. Cohen-Tannoudji, B. Diu, and F. Laloë.

Webpage

Lecture notes and homework will be posted at <http://www.physics.siu.edu/~shajesh>. It is advised to download relevant materials to your computer, because the website (or internet) could be down on occasion.

4 Course work

Evaluation

Homework	30 %
Take-Home Exams ($2 \times 10\%$)	20 %
Midterm Exams ($2 \times 15\%$)	30 %
Final Exam	20 %

Homework

Homework will be assigned roughly every ten days. It will be available on the course webpage. Students are encouraged to discuss homework problems with their classmates, instructor, and anyone. But, each student should submit their own work describing detailed steps of thought process.

Take-Home Exams

Two take-home exams will be administered. It will be available on the course webpage.

Exams

Three examinations (including the final exam) will be administered.

Midterm Exam I	February 13 (Thursday, 6:00pm-8:00pm)
Midterm Exam II	March 27 (Thursday, 6:00pm-8:00pm)
Final Exam	May 8 (Thursday, 10:10am-12:10pm)

The midterm exams will assess you on concepts covered in lectures and homework. Midterm exams will be an hour-long exam, but, to remove the time factor, you will be allowed to take extra time. All the midterm exams will be cumulative, but you are recommended to concentrate more on topics covered in the later part of the semester. The Final Exam will be graded such that, if you score within twenty percent of your semester average, your scores will not go below your semester average. Typically, the Final Exam could bring up your grade, and rarely brings it down.

Grading

The grading will be done on a scale of 0-100. This raw score should be used to assess your knowledge in the subject. The raw score will be converted to the university scale using the following formula

$$(\text{Your Score}) = \frac{(\text{Raw Score})}{2} + 50. \quad (1)$$

For example, a Raw Score of 60 will lead to Your Score of 80.

5 Syllabus Attachment

The Provost Office has created a “Syllabus Attachment” to assist the student. It lists and provides web links for many elements that are important for a student. Kindly find it attached.

*"We emphasize student achievement and success because achievement and success are essential if we are to shape future leaders and transform lives."*¹

<http://pvcaa.siu.edu/>

IMPORTANT DATES *

<u>Semester Class Begins</u>	01/13/2014
<u>Last day to add a class</u> (without instructor permission):	01/24/2014
<u>Last day to withdraw completely and receive a 100% refund:</u>	01/26/2014
<u>Last day to drop a course using SalukiNet:</u>	03/23/2014
<u>Last day to file diploma application</u> (for name to appear in Commencement program):	03/28/2014
<u>Final examinations:</u>	5/5 – 5/9/2014

* Note: For outreach, online, and short course drop/add dates, visit Registrar's Academic webpage <http://registrar.siu.edu/>

SPRING SEMESTER HOLIDAYS

Martin Luther King, Jr.'s Birthday 01/20/2014

Spring Vacation 03/08—03/16/2014

WITHDRAWAL POLICY ~ Undergraduate only

Students who officially register for a session may not withdraw merely by the stopping of attendance. An official withdrawal form needs to be initiated by the student and processed by the University. For the proper procedures to follow when dropping courses and when withdrawing from the University, please visit <http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

INCOMPLETE POLICY~ Undergraduate only

An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within one semester following the term in which the course was taken, or *graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, that is, by no later than the end of the semester following the term in which the course was taken, or graduation, whichever occurs first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student's grade point average. For more information please visit:

<http://registrar.siu.edu/grades/incomplete.html>

REPEAT POLICY

An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit no more than two times (two total enrollments) unless otherwise noted in the course description. For students receiving a letter grade of A,B,C,D, or F, the course repetition must occur at Southern Illinois University Carbondale. Only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned. See full policy at

<http://registrar.siu.edu/pdf/ugradcatalog1314.pdf>

GRADUATE POLICIES

Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please visit

<http://gradschool.siu.edu/about-us/grad-catalog/index.html>

DISABILITY POLICY

Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements.

<http://disabilityservices.siu.edu/>

STUDENT CONDUCT CODE

http://policies.siu.edu/other_policies/chapter3/conduct.html

SALUKI CARES

The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: (618) 453-5714, or siucares@siu.edu,

<http://salukicare.siu.edu/index.html>

EMERGENCY PROCEDURES

Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. We ask that you become familiar with the SIU **Emergency Response Plan** and **Building Emergency Response Team (BERT)** programs. Emergency response information is available on posters in buildings on campus, available on BERT's website at www.bert.siu.edu, Department of Safety's website at www.dps.siu.edu (disaster drop down) and the Emergency Response Guideline pamphlet. Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. *It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.*

INCLUSIVE EXCELLENCE

SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ is an important part of education as well as an essential preparation for any career. For more information please visit: <http://www.inclusiveexcellence.siu.edu/>

MORRIS LIBRARY HOURS

<http://www.lib.siu.edu/about>

LEARNING AND SUPPORT SERVICES

Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:

Tutoring : <http://tutoring.siu.edu/>

Math Labs http://tutoring.siu.edu/math_tutoring/index.html

WRITING CENTER

The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit

<http://write.siu.edu/>

AFFIRMATIVE ACTION & EQUAL OPPORTUNITY

Our office's main focus is to ensure that the university complies with federal and state equity policies and handles reporting and investigating of discrimination cases. For more information visit:

<http://diversity.siu.edu/#>

Additional Resources Available:

SALUKINET: <https://salukinet.siu.edu/cp/home/displaylogin>

ADVISEMENT: <http://advisement.siu.edu/>

PROVOST & VICE CHANCELLOR: <http://pvcaa.siu.edu/>

SIU ONLINE: <http://online.siu.edu/>