

# PHYS 530A: QUANTUM MECHANICS II

SYLLABUS (2016 Spring)

*Department of Physics, Southern Illinois University–Carbondale*

Last updated: January 18, 2016

## 1 General information:

Instructor: K. V. Shajesh  
Office: Neckers 491, Tel.: +1-618-453-5212.  
Email: [shajesh@siu.edu](mailto:shajesh@siu.edu)

Web-page: <http://www.physics.siu.edu/~shajesh>  
Class meetings: TR 9:35-10:50AM, in Neckers 410.  
Office hours: TR 11:00 AM-Noon; MWF 1:00 PM-1:30 PM;  
MTWRF 3:00 PM-3:30 PM.

## 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: representation of linear transformations using matrices, complex analysis, 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 the 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. Lecture notes for PHYS-530A Quantum Mechanics II (2014 Spring), available at <http://www.physics.siu.edu/~shajesh/tc/201401-SIU-P530A/>.
2. *Quantum Mechanics: Symbolism of Atomic Measurements*, by J. Schwinger, edited by B.-G. Englert.
3. Schwinger's Quantum Action Principle, by K. A. Milton, <http://arxiv.org/abs/1503.08091>.
4. *Introduction to Quantum Mechanics*, lecture notes by K. A. Milton, available at <http://www.nhn.ou.edu/~milton/p3803-12.html> and <http://www.nhn.ou.edu/~milton/p4803-12.html>.
5. *Quantum Mechanics*, by L. I. Schiff.
6. *Principles of Quantum Mechanics*, by R. Shankar.
7. *Quantum Mechanics*, by E. Merzbacher.
8. *Modern Quantum Mechanics*, by J. J. Sakurai.
9. *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 the internet) could be occasionally down.

## 4 Course work

### Evaluation

Homework	30 %
Midterm Exams (3× ~ 16.7 %)	50 %
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.

### Exams

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

Midterm Exam 1	February 18 (Thursday, in class)
Midterm Exam 2	March 22 (Tuesday, in class)
Midterm Exam 3	April 21 (Thursday, in class)
Final Exam	May 12 (Thursday, 8:00-10:00 AM)

The midterm exams will assess you on concepts covered in lectures and homework. Midterm exams will be an hour-long exam. All the midterm exams will be cumulative, but you are recommended to concentrate more on topics covered in the later part of the semester.

### 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.

### IMPORTANT DATES \*

Semester Class Begins.....	01/19/2016
Last day to add a class (without instructor permission):.....	01/24/2016
Last day to withdraw completely and receive a 100% refund: .....	01/31/2016
Last day to drop a course using SalukiNet:.....	04/03/2016
Last day to file diploma application (for name to appear in Commencement program): .....	02/12/2016
Final examinations: .....	05/09–05/13/2016

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

### SPRING SEMESTER HOLIDAYS

Martin Luther King, Jr.'s Birthday Holiday 01/18/2016

Spring Break 03/12—03/20/2016

### 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/catalog/undergraduatecatalog.html>

### 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/catalog/undergraduatecatalog.html>

### 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/>

### PLAGIARISM

Student Conduct Code [http://srr.siu.edu/student\\_conduct\\_code/](http://srr.siu.edu/student_conduct_code/)

Guidelines for Faculty <http://pvcaa.siu.edu/common/documents/Plagiarism/Guide%20to%20Preventing%20Plagiarism.pdf>

### MORRIS LIBRARY HOURS

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

### SAFETY AWARENESS FACTS AND EDUCATION

Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: <http://safe.siu.edu>

### 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](mailto: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](http://www.bert.siu.edu), Department of Safety's website at [www.dps.siu.edu](http://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/>

### 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://math.siu.edu/courses/course-help.php>

### 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/>