PHYSICS 661 QUANTUM MECHANICS II Spring 2006

Instructor: Professor T.E. Clark

Office: Room 254, Physics Building

Office Phone: 49-43038

E-Mail: clark@physics.purdue.edu

T.A.: Liang Wang

Office: Room 104, Physics Building

Office Phone: 49-63202

E-Mail: lwang@physics.purdue.edu

Office Hours: T 2:30-3:30 p.m.

Office Hours: TBA

Class Hours: T, Θ 10:30 a.m.-11:45 a.m.

Class Room: Room 111, Physics Building

Text: **Quantum Mechanics**, Vol. 1 and 2, by C. Cohen-Tannoudji, B. Diu and F. Laloë.

Homework: Specific reading assignments will be given supplementing the lecture material covered in class.

Homework problems will be assigned regularly. Problem solving is an essential as well as an integral part of this course and your homework grades will count approximately 50% towards your course grade. You may discuss the problems with each other in a general way but you should not do the homework as a group effort. If your homework is copied from another student's, that homework will not be accepted and a zero score will be given for it. Further, the problem solutions should be clearly and neatly written on **one side only** of standard size paper. Your fellow students should be able to read, follow and understand the solutions. The quality of the presentation counts towards the grade. The problem sets will be written in a format that has your name, PHYS 661, and the due date in the upper right hand corner of the first page and your name and PHYS 661 on each following page; the problem set number on the first page and each page numbered. As well, the question should first be written out (if a long question, re-write it in an outlined form) and then followed by the solution. See the example format shown on the attached sheet. Homework is to be handed in at the beginning of the class period on the date it is due. **No late assignments are accepted.**

Exams & Grades: There will be a comprehensive final exam at the end of the semester.

Your course grade will be based on the scores for the final exam and homework sets, with the approximate weights:

Homework	50%
Final exam	50%

The final exam will be scheduled during the week beginning 1 May.

References: Besides our textbooks, the following books will be on reserve in the Physics Library.

A) Undergraduate Level

i) Elementary

1. R.P. Feynman, R.B. Leighton and M. Sands: **The Feynman Lectures on Physics,Vol. III: Quantum Mechanics**
2. E.H. Wichmann: **Berkeley Physics Course, Vol. 4: Quantum Physics**
3. A. P. French and Edwin F. Taylor: **An introduction to quantum physics.**

ii) Intermediate

1. B.H. Brandsen and C.J. Joachain: **Introduction To Quantum Mechanics**
2. S. Gasiorowicz: **Quantum Physics**
3. D.J. Griffiths: **Introduction To Quantum Mechanics**
4. R.L. Liboff: **Introductory Quantum Mechanics**
5. R. Shankar: **Principles Of Quantum Mechanics**, 2nd edition

B) Graduate Level (Advanced)

1. L.E. Ballentine: **Quantum Mechanics**
2. C. Cohen-Tannoudji, B. Diu and F. Laloë: **Quantum Mechanics**, Vol. 1 and 2
3. P.A.M. Dirac: **The Principles Of Quantum Mechanics**
4. K. Gottfried**: Quantum Mechanics Vol. I: Fundamentals**
5. J.M. Jauch: **Foundations of Quantum Mechanics**
6. L.D. Landau and E.M. Lifshitz: **Quantum Mechanics, Nonrelativistic Theory**
7. E. Merzbacher: **Quantum Mechanics**
8. A. Messiah: **Quantum Mechanics**, Vol. 1 and 2
9. J. von Neumann: **Mathematical Foundations of Quantum Mechanics**
10. J.J. Sakurai: **Modern Quantum Mechanics**
11. L.I. Schiff: **Quantum Mechanics**

C) Problems and Solutions

1. F. Constantinescu and E. Magyari: **Problems In Quantum Mechanics**
2. S. Flügge: **Practical Quantum Mechanics,** I and II
3. D. Ter Haar: **Selected Problems In Quantum Mechanics**

Example of Homework Format

Example of Homework Format
For Physics 661

Name
Physics 661
Date Due

Problem Set #3

1) (Write each question in its entirety)

Determine $\langle x|\hat{X}\hat{P}|\psi\rangle$ in terms of $\langle x|\psi\rangle$.

Solution:

Insert a complete set of momentum eigenstates, $1=\int dp\,|p\rangle\langle p|$, between $\hat{P}$ and $|\psi\rangle$ and use the fact that $\langle x|\hat{X} = x\langle x|$ and $\hat{P}|p\rangle = p|p\rangle$ to find

$$\langle x|\hat{X}\hat{P}|\psi\rangle = \langle x|x\hat{P}\int dp\,|p\rangle\langle p|\psi\rangle$$

$$= \int dp\,\langle x|xp|p\rangle\langle p|\psi\rangle$$

$$= \int dp\,xp\,\langle x|p\rangle\langle p|\psi\rangle$$

Name
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Date Due

Problem Set #3

1) Using the fact that $\langle x|p\rangle = \frac{1}{\sqrt{2\pi\hbar}} e^{ipx/\hbar}$,
we have that $\frac{\hbar}{i}\frac{\partial}{\partial x}\langle x|p\rangle = p\langle x|p\rangle$.
Hence we find the desired result

$$\langle x|\hat{x}\hat{P}|\psi\rangle = x\frac{\hbar}{i}\frac{\partial}{\partial x}\int dp\,\langle x|p\rangle\langle p|\psi\rangle$$

$$\boxed{\langle x|\hat{x}\hat{P}|\psi\rangle = x\frac{\hbar}{i}\frac{\partial}{\partial x}\langle x|\psi\rangle.}$$