660 SYLLABUS Fall 2014 (3 credit hours)
Mo/We 2.00-3.15pm

COURSE: **Quantum Mechanics I**
ALL course information is posted on BlackBoard

TEXT/Materials: Lecture notes and homework are posted on blackboard

CLASS MEETINGS: Lecture Section 1: **Mo/We 3:30-4:45 pm**, Tourette 227

Instructor: Michel van Veenendaal, Tourette 223; 815-753-0667
Office Hours: **Mo/We 2-3 pm** (although I am generally available during the day on Mo/We).
Email: veenendaal@niu.edu
Web page: See blackboard

SCHEDULE OF TESTS:

MIDTERM **Monday 10/19, 3.30-4.45pm**
FINAL **Monday 12/7, 2-3.50pm** (be aware of potential exam conflicts)

GRADING:

- Homeworks 40% (there will be four graded homeworks, dates TBD).
- Midterm 30%
- Final 30%

The final grades are curved. Therefore, the final grade depends on the distribution of the grades. Typical relationships between the weighted tests/final and the grades are

A	> 85
B	70 - 85
C	55 - 70
D	TBD

Note that these ranges are indicative and that the instructor retains the right to change the values depending on the performance of the students and the difficulties of the exams.

MINIMUM REQUIREMENTS TO PASS THE COURSE:

- An aggregate numerical value of at least 50% of the total points is required to pass the course, with no component (homework, midterm, final) worse than 25%.

HOMEWORK ASSIGNMENTS:

- 4 sets, with clearly defined due dates/times.

- Late turn in of homework permissible only under unusual circumstances.

COURSE DESCRIPTION:

Quantum mechanics I offers an in-depth introduction to the field including the necessary mathematical details. Topics include: wave and matrix mechanics, potential problems, the harmonic oscillator, propagation in space and time, harmonic oscillator, perturbation theory, hydrogen atom, molecules and solids, spin.

Prerequisites: previous course(s) on Quantum Mechanics at the level of D.J. Griffiths, Introduction to Quantum Mechanics, Prentice-Hall

Required textbook: The class will be taught on lecture notes which are available on blackboard.

Optional Readings.
For a deeper understanding, you may also want to consult these books:
R. L. Liboff, Introductory Quantum Mechanics
E. Merzbacher, Quantum Mechanics
R. Shankar, The Principles of Quantum Mechanics
Note that there are many other textbooks available at different levels.

SYLLABUS:

4.2 The Gaussian wave packet
4.3 Phase and group velocities
4.4 Heisenberg's uncertainty principle
4.5 Unitary transformations

5 Harmonic oscillator
5.1 Harmonic oscillator
5.2 Schrödinger equation approach
5.3 Solution using operators
5.4 Harmonic oscillator in matrix form
5.5 Operators and wavefunctions
5.6 Correspondence principle
5.7 Two-dimensional harmonic oscillator

6 Perturbation Theory
6.1 Time-independent perturbation theory
6.2 Infinite perturbation theory
6.3 Green's functions
6.4 Time-dependent perturbation theory

7 Hydrogen atom
7.1 Spherical coordinates
7.2 Angular momentum
7.3 Spherical harmonics
7.4 Angular momentum in matrix form
7.5 Higher-order tensors
7.6 Radial wavefunction
7.7 Conceptual aside: The hydrogen atom in terms of bosons

8 Molecules and solids
8.1 Creation and annihilation operators
8.2 Systems with a finite size: the benzene molecule
8.3 A linear chain of 1*s* orbitals
8.4 Nearly free-electron model in one dimension
8.5 Tight-binding versus nearly-free electron model

9 Spin
9.1 spin
9.2 Massless particle
9.3 The geometry of space: Two dimensions
9.4 Geometry of Space: Three dimensions
9.5 Matrices as unit vectors

COURSE POLICIES INCLUDE:

1. Be respectful of each other (this applies to Instructors, TA's and students). Some specifics include:

    a. No cell phone/ electronic device usage in class (except calculators). Cell/ smart phones must be turned off or silenced and placed in backpacks, etc. (not in pockets or on desks). Violators may be required to turn in their devices to the Instructor for the remainder of the class period.

b. If you need to leave class early, let your Instructor/ TA know

2. Laptops/ notebooks may be used for lecture materials and taking notes only.

3. Be aware of the policies and procedures regarding your rights as well as responsibilities that are published in the NIU Student Code of Conduct. It is available on line at http://www.niu.edu/conduct/Student_Code_of_Conduct/index.shtml

4. The instructor and the university reserve the right to modify, amend, or change the course syllabus (course requirements, grading policy, etc.) as the curriculum and/or program require.

5. Americans with Disabilities Statement (available at: http://niu.edu/disability/accessibility_statement/index.shtml)

6. For academic integrity, see http://www.niu.edu/stat/courses/pdfs/Accessibility_Statement.pdf