Physics 181: Quantum Mechanics

(Fall 2015)

Instructor: Dr. Klaus Bartschat
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Office Hours: MWF 2 – 3 p.m.; R 4 – 6 p.m.

Time: MWF 12:30 p.m. – 1:45 p.m.

Place: Harvey Ingham (room 112)

Text: "Introduction to Quantum Mechanics", D.J. Griffith, 2nd edition
Prentice Hall (2005); ISBN 0-13-111892-7

Topics Covered: (Subject to Revision)

Ch. 1	Introduction: The Wave Function and its Interpretation
Ch. 2	Quantum Mechanics in One Dimension: Time-Independent vs. Time-Dependent Approach
Ch. 3	Mathematical Formalism
Ch. 4	Time-Independent Quantum Mechanics in Three Dimensions: Hydrogen Atom, Angular Momentum, Spin
Ch. 5	Identical Particles: Many–Electron Systems
Ch. 6	Selected Elements of Perturbation Theory
Ch. 7	Selected Elements of Variational Theory
Ch. 11	Introduction to Quantum Collision Theory
Afterword	Comments on the Theory of Measurement

Anticipated Outcomes:

1) You will gain a basic knowledge of the above topics. Specifically, you will apply already existing knowledge of ordinary differential equations and further extend it, particularly to complex-valued functions. You will also learn the importance of symmetry considerations and apply them to greatly simplify the solution of physical problems. In addition, you will apply and further extend your knowledge of linear algebra, particularly with respect to hermitian operators and eigenvalue problems involving such operators.
2) You will be able to set up the solution of typical textbook problems in these areas.
3) You will be able to solve such problems either analytically (possibly with the help of symbolic computing packages such as Mathematica or Maple) or numerically using EXCEL, FORTRAN, C++, or other programming languages.
4) You will understand the basic philosophical consequences of Quantum Mechanics as a highly accurate but nevertheless "non-deterministic theory." Although certain observables for a single particle cannot be measured simultaneously to arbitrary accuracy, experimental findings can be reproduced (within the limits of Heisenberg's Uncertainty Principle) and interpreted using the mathematical framework established in the theory.

1) Examinations:
There will be two class tests during the term and one final exam. The first test will cover the subject matter of Chapters 1–3, while the second test will cover (predominantly) Chapters 4–7. The final exam (currently scheduled for Monday, Dec. 14, 2015, 9:30 – 11:20 a.m.) will be **comprehensive** over the entire course subject matter.

Exams will be graded on a relative scale, i.e., the percentages required for a particular grade will depend on the level of difficulty.

NOTE: There will be no make-up exams! If you miss a class a test, a grade of F will be assigned, except if you can provide a medical certificate showing your inability to take the test at the scheduled time. In that case, the test will be replaced by an **oral examination**.

2) Homework: Since it has become too easy to obtain the solutions manual from the internet, I will generally recommend problems for the individual chapters that you should try to solve on your own and let me know if you have trouble. No credit will be given (or deducted) for doing these problems from the book – other than that you may wish you had done them when it comes to the tests. I may hand out problems that are not in the book as well as computer projects. These problems and projects will have deadlines. If a due date is missed, every day late will result in subtracting 20% of the maximum possible number of points. For example, if your work is worth 40 points out of a maximum of 50 points but handed in two days late, you will only be credited 20 points (40 - 40% times 50).

3) Overall Grading: The total grade will consist of:

item	percentage weight
Test 1	25 %
Test 2	25%
Final Exam	35 %
Homework, including computer projects	15 %

For each individual item, you will receive grades including (+) and (-), and the final grade will be calculated as the weighted average of the individual performances. It will then be rounded off to the nearest full grade.

NOTE:
a) Homework and computer grades cannot lead to a better final grade than your best test grade! For example, if your homework and computer projects are all A's, but all your tests are D's, you will get a D rather than a C in this course.
b) Purely mathematical schemes like the one outlined above will generally yield a good estimate of the final grade. Nevertheless, there may be exceptions, such as having a very good or very bad day on an exam. **The final result may deviate from the above estimate by a grade (up or down) if special circumstances seem to warrant it.**

4) Withdrawing:
You may drop this class without a "W" until Monday, Sept. 14, 2015. You may also withdraw from the class with a "W" by Wednesday. Oct. 28, 2015. Note that this class is only required for a BS degree in Physics.

5) Academic Dishonesty:
Any incidence of academic dishonesty will result in a failing grade. Furthermore, any such incident will be reported to the dean of the student's college, for possible further penalties.