PHYSICS 742 – QUANTUM MECHANICS II

Monday, Wednesday, and Friday, 12:00 – 12:50 pm MWF

Instructor: Eric Carlson
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My Web: http://users.wfu.edu/ecarlson
Class Web: http://users.wfu.edu/ecarlson/quantum/index2.html
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Office Hours
MWF 11:00 – 11:45, TR 9:30 – 11:00
or any time by appointment

Text: *Quantum Mechanics* by Eric D. Carlson. Available on the website

Other Books: *Modern Quantum Mechanics* by J.J. Sakurai
Quantum Mechanics, a modern development by Leslie Ballentine
Quantum Mechanic Vol. I and II by C. Cohen-Tannoudji et al.
Quantum Mechanics by Leonard Schiff
Quantum Mechanics: Fundamentals by Gottfried and Yan

Description: This course is the second half of a one-year course designed to teach the fundamentals of quantum mechanics, the mathematical methods used in quantum, and details of interesting quantum mechanical systems. The text and all the power point presentations are available online.

Survey: Please fill out the survey **https://forms.gle/sZwWasXWtKrELRN5A**, preferably before class starts.

Materials: A scientific calculator is considered a necessity, though I'm not sure how much you will actually use it. It is highly advisable to have access to a symbolic manipulation program, like *Maple*.

Exams: There will be two exams, each approximately two hours long, each probably from 10:55 – 12:55. The first test will be around March 6 and the second around April 22. They count equally. There is no final during finals week.

Homework: There will be homework assignments almost every day, due at the start of class, almost always chosen from the textbook. They will be posted on the web page well in advance. I suggest you get started on your homework early. You should attempt to do the homework by yourself, but if you get stuck, you should feel free to talk to your friends or myself. In particular, you should also feel free to check your final answers with your friends. Part of doing physics is interacting with others. You must ultimately understand and have performed all the calculations in your homework yourself, but I do not mind if others have helped you with it.

Late homework: Penalized 20% per day late. However, you will be given two homework passes, which you may twice use to **delay** turning in that homework until the next regular class period. You can also get free passes due to illness, or any other excuse approved by Dr. Carlson in advance (such as attending a conference)

Student Problem Presentations: During the last two weeks, you will do problems assigned, probably from previous quantum qualifying exams, on the board or using presentation software. You will be graded on the correctness with which you solve these problems, and the clarity with which you present your solutions. More details will be provided closer to the time of these presentations.

Attendance: Attendance is expected every class period, but if you have to be away, just let me know. I do not grade on attendance, but I expect it.

Web: The website is **http://users.wfu.edu/ecarlson/quantum/index2.html .** Essentially all materials for this class can be found at this website, and some materials, like solutions to homework sets, can be found *only* on the website.

Grading: The two tables at right are a not necessarily accurate guess as to what my grading scheme will be. In particular, I reserve the right to grade on a sliding scale. I anticipate that most people in this class will get A's or B's. If you are getting C's on homework, you probably are confused and will get more confused, and it's time to get some help. If you are getting B's, you probably are understanding most of the material, though you may be having some difficulty. If you are getting A's, you are understanding a lot and are working hard.

Grading Breakdown	
Homework:	40%
Test 1:	20%
Test 2:	20%
Presentations:	10%
Participation:	10%

Grading Scale			
94%	A	78%	B-
90%	A-	74%	C+
86%	B+	70%	C
82%	B	<70%	F

Tentative Schedule:

January		17	19	Time Evolution, Propagator
January	22	24	26	Heisenberg Picture, State Operator
Jan/Feb	29	31	2	Bell's Inequality, Measurement, Many Worlds Picture
February	5	7	9	Variational Method, WKB method, Perturbation Theory
February	12	14	16	Degenerate Perturbation Theory, Finite Nucleus, Spin-Orbit Coupling
February	19	21	23	Hyperfine Splitting, Zeeman Effect, Van der Waals force
Feb/Mar	26	28	1	Cross-Sections and Scattering, Born Approximation, Partial Waves
March	4	**6**	8	Sudden/Adiabatic Approximation, **Test 1**, Time-depend. Pert. Theory
March	18	20	22	Harmonic Pert., E&M Waves and the Dipole Approx., Constant Pert.
March	25	27	29	The Dirac equation, Quantizing the Electromagnetic Field
April	1	3	5	Photons, the Vacuum, Casimir Effect
April	8	10	12	Photons and Atoms, Photon Scattering, Diagrammatic Methods, Thomson Scattering
April	15	17	19	Scattering Away from or Near a Resonance, review
April	**22**	24	26	**Test 2**, Practice problems from Qualifier
April/May	29	1		Practice problems from Qualifier
May	6			(2 – 4 pm) Practice problems from Qualifier

Name	**Phone**	**email**	**Office**