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 textbook - “Modern Quantum Mechanics”, 2<sup>nd</sup> edition, J.J. Sakurai and J.J. Napolitano  
 Final exam date TBD, Most likely it will be a take home exam.

### PHYS 5321 Quantum Mechanics

Formal structure of quantum mechanics, Schrödinger theory and applications to soluble systems, angular momentum and rotation matrices.

We will cover at least the material in chapters 1 and 2 of our book. This consists in developing the bra-ket and matrix notation for abstract vector spaces and a study of quantum dynamics. The third chapter deals with angular momentum and we will try to get as far as possible into it. The schedule below optimistically assumes we will get through most of chapter 3.

Grades will be based on two midterm exams and the final exam. These will be take home exams. Exams will cover the material we discussed in class and not material which we have not yet reached. Recommended homework from Sakurai is below. Unfortunately, I can not use the problems from Sakurai as a component of the grade. These solutions are everywhere on the internet. There may be independently assigned homework during the semester that can be included in the grade. Approximate grading scheme: midterm exams 20% each, final exam 40% to 60% depending on HW assigned up to 20%.

Lecture	date	Sections in Sakurai	Recommended problems
1	08/23/22	1.1, Stern-Gerlach experiment, <a href="#">L1.1.pdf</a> , <a href="#">HW0</a>	4
2	08/25/22	1.2, Kets, Bras, Operators, <a href="#">L1.2.pdf</a> , <a href="#">HW1</a>	5, 8
3	08/30/22	1.3, 1.4, Base kets, Matrix representation, <a href="#">L1.3.4.pdf</a> <a href="#">matrices.operators.pdf</a>	10, 15, <a href="#">HW2</a>
4	09/01/22	1.4, Observables, Uncertainty relations, <a href="#">L1.4.pdf</a>	16,18, <a href="#">Quiz1</a>
5	09/06/22	1.5, 1.6, Basis change, <a href="#">L1.5.6.pdf</a>	23, 22
6	09/08/22	1.6, Position, Momentum, Translation, <a href="#">L1.6A.pdf</a> <a href="#">periodic boundary conditions</a> <a href="#">L1.6B.pdf</a>	28, 29 <a href="#">Quiz2</a>
7	09/13/22	1.7, Wave functions in position and momentum space <a href="#">functions.of.operators.pdf</a> <a href="#">L1.7.pdf</a>	30, 33
8	09/15/22	2.1, Time evolution and Schrödinger equation, <a href="#">L2.1.pdf</a>	1, 4
9	09/20/22	2.1, 2.2, Schrödinger vs Heisenberg picture, <a href="#">L2.1.2.pdf</a>	7
10	09/22/22	2.2, Schrödinger vs Heisenberg picture, <a href="#">midterm1</a> <a href="#">distributed</a> <a href="#">L2.2.pdf</a>	9 <a href="#">Quiz3</a>
11	09/27/22	2.3, Simple Harmonic Oscillator, <a href="#">L2.3.pdf</a>	11 <a href="#">HW3</a>
12	09/29/22	2.4, Schrödinger wave equation, <a href="#">midterm1 collected</a> <a href="#">L2.4.pdf</a>	14
13	10/04/22	2.5, Elementary solutions Schrödinger wave equation <a href="#">L2.5A.pdf</a> <a href="#">neutron bounce</a>	16 <a href="#">HW4.pdf</a>
14	10/06/22	<a href="#">L2.5B.pdf</a>	17, 18

15	10/11/22	2.5, 2.6. Propagators <a href="#">L2.5.6.pdf</a>	19, 22,
16	10/13/22	2.6, Feynman Path Integrals <a href="#">L2.6.7.pdf</a>	25, 27
17	10/18/22	2.7, Potentials and Gauge transformations <a href="#">L2.7A.pdf</a>	30, 31
18	10/20/22	2.7, <a href="#">L2.7B.pdf</a>	33, 36
19	10/25/22	2.7 <a href="#">gauge.transform.pdf</a>	37 <a href="#">Quiz4</a>
20	10/27/22	3.1, 3.2 Angular Momentum Commutators, <b>midterm2 distributed</b> <a href="#">L3.1.2A.pdf</a>	1
21	11/01/22	3.2 Spin $\frac{1}{2}$ , Finite rotations <a href="#">L3.2.pdf</a>	2, 5
22	11/03/22	3.3, 3.4, SO(3), SU(2), Euler rotations, <b>midterm2 collected</b>	9 <a href="#">L3.3.pdf</a>
23	11/08/22	3.4 Density operators, Ensembles <a href="#">L3.4.pdf</a>	10, 14
24	11/10/22	3.4, 3.5 Eigen states of angular momentum <a href="#">L3.5.pdf</a> Veterans' Day no classes	15, 16
25	11/15/22	3.5, 3.6 Orbital Angular momentum	18, 19
26	11/17/22	3.6, 3.7 Schrödinger equation Central potentials	20
		Fall Break, no classes	22
27	11/29/22	3.8 Addition of angular momentum <a href="#">L3.8.pdf</a>	23
28	12/01/22	3.8 Addition of angular momentum	24, 28
29	12/06/22	3.10 Spin correlations, <a href="#">Bell's inequality</a> <a href="#">EPR &amp; QM</a> <a href="#">L3.10.pdf</a>	32
30	12/08/22	3.11 Tensor operators <a href="#">L3.11.pdf</a> <a href="#">nuclear.tensors.pdf</a>	33