FYS4110 – Fall semester 2022

The following is a tentative plan for the lectures with approximate what topics will be discussed each week. Adjustments to the plan may come if needed. Normally, we will introduce new material on Tuesday (10:15-12) and Wednesday (14:15-16) and discuss problems on Tuesday (12:15-14). Numbers refer to sections in the lecture notes. AN=additional lecture notes

Week	Topics covered in the lectures
34 (22/8-26/8)	1.1 Postulates of Quantum mechanics 1.4.1 Two level systems (TLS)
35 (29/8-2/9)	1.4.2 Dynamics of TLS in an external field. Rabi oscillations 1.3.1 Different pictures of time evolution 1.2 Field quantization Problem set 1
36 (5/9-9/9)	1.4.3 The Jaynes Cummings model 1.4.4 Coherent states of the harmonic oscillator Problem set 2
37 (12/9-16/9)	1.3.2 Path integrals Problem set 3
38 (19/9-23/9)	2.1 Pure and mixed states. Density matrices 2.1.2 Entropy of a mixed quantum state Problem set 4
39 (26/9-30/9)	2.2 Entanglement 2.3 The EPR experiment and Bell's inequalities+ AN1 Problem set 5
40 (3/10-7/10)	Midterm exam (due Friday 7/10) . No teaching .
41 (10/10-14/10)	3.1 Interaction free measurements + AN2 3.2-3.5 Quantum communication + AN4 AN3 Quantum cryptography Problem set 6
42 (17/10-21/10)	3.6 Quantum computers: Principles and algorithms + AN5.1 Problem set 7
43 (24/10-28/10)	Simulating physics on quantum computers. AN5.2-5.3 Problem set 8
44 (31/10-4/11)	Physical systems for quantum computing Problem set 9
45 (7/11-11/11)	4.1 Classical electromagnetism 4.2 Quantizing the EM field Problem set 10
46 (14/11-18/11)	4.3 Photon emission and absorption 4.4 Stimulated emission and lasers Problem set 11
47 (21/11-25/11)	4.5 Open quantum systems: Derivation of Lindblad equation + AN6

	AN6 Examples of Lindblad equations Problem set 12
48 (28/11-2/12)	Summary and discusion of important concepts. Questions Problem set 13