FYS4110 – Fall semester 2020

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 (12:15-14) and Wednesday (12:15-14) and discuss problems on Monday (14:15-16). Numbers refer to sections in the lecture notes.

Week	Topics covered in the lectures
34 (17/8-21/8)	1.1 Postulates of Quantum mechanics 1.4.1 Two level systems (TLS)
35 (24/8-28/8)	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 (31/8-4/9)	1.4.3 The Jaynes Cummings model 1.4.4 Coherent states of the harmonic oscillator Problem set 2
37 (7/9-11/9)	2.1 Pure and mixed states. Density matrices 2.1.2 Entropy of a mixed quantum state Problem set 3
38 (14/9-18/9)	2.2 Entanglement 2.3 The EPR experiment and Bell’s inequalities Problem set 4
39 (21/9-25/9)	3.1 Interaction free measurements 3.2-3.5 Quantum communication Quantum cryptography
40 (28/9-2/10)	Problem set 5 Problem set 6
41 (5/10-9/10)	3.6 Quantum computers: Principles and algorithms Problem set 7
42 (12/10-16/10)	Simulating physics on quantum computers Problem set 8
43 (19/10-23/10)	Midterm exam (due 23/10) . No teaching (we will arrange a time to meet and discuss the problems).
44 (26/10-30/10)	Physical systems for quantum computing 1.3.2 Path integrals Problem set 9
45 (2/11-6/11)	4.1 Classical electromagnetism 4.2 Quantizing the EM field Problem set 10
46 (9/11-13/11)	4.3 Photon emission and absorption 4.4 Stimulated emission and lasers Problem set 11

47 (16/11-20/11)	4.5 Open quantum systems: Derivation of Lindblad equation 4.5 Examples of Lindblad equations Problem set 12
48 (23/11-27/11)	Summary and discusion of important concepts. Questions Problem set 13