

FYS4110 – Fall semester 2021

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 (12:15-14) and discuss problems on Thursday (10:15-12). Numbers refer to sections in the lecture notes. AN=additional lecture notes

Week	Topics covered in the lectures
34 (23/8-27/8)	1.1 Postulates of Quantum mechanics 1.4.1 Two level systems (TLS) 1.4.2 Dynamics of TLS in an external field. Rabi oscillations
35 (30/8-3/9)	1.3.1 Different pictures of time evolution 1.2 Field quantization Problem set 1 Problem set 2
36 (6/9-10/9)	1.4.3 The Jaynes Cummings model 1.4.4 Coherent states of the harmonic oscillator Problem set 3
37 (13/9-17/9)	2.1 Pure and mixed states. Density matrices 2.1.2 Entropy of a mixed quantum state Problem set 4
38 (20/9-24/9)	2.2 Entanglement 2.3 The EPR experiment and Bell's inequalities + AN1 4.1 Classical electromagnetism
39 (27/9-1/10)	4.2 Quantizing the EM field 4.3 Photon emission and absorption Problem set 5
40 (4/10-8/10)	Rest of Problem set 5 Problem set 6 Problem set 7
41 (11/10-15/10)	4.4 Stimulated emission and lasers 4.5 Open quantum systems: Derivation of Lindblad equation + AN6 Problem set 8
42 (18/10-22/10)	4.5 Open quantum systems: Derivation of Lindblad equation AN6 Examples of Lindblad equations Problem set 9
43 (25/10-29/10)	Midterm exam (due 29/10) . No teaching (we will arrange a time to meet and discuss the problems).
44 (1/11-5/11)	3.1 Interaction free measurements + AN2 3.2-3.5 Quantum communication + AN4 AN3 Quantum cryptography Problem set 10
45 (8/11-12/11)	3.6 Quantum computers: Principles and algorithms. + AN5.1

	Problem set 11
46 (15/11-19/11)	Physical systems for quantum computing Simulating physics on quantum computers. AN5.2-5.3 Problem set 12
47 (22/11-26/11)	1.3.2 Path integrals Problem set 13
48 (29/11-3/12)	Summary and discussion of important concepts. Questions