# Course outline, TNE041 Modern Physics 2019

| Week | Lecture | Tutorial,<br>Lab session | Chapters (according to Harris: Modern Physics), contents |
|---|---|---|---|
| 4 | 1,2 | 1 | 1: Introduction<br>2.1,2.7: Relativity theory<br>3,4.1-4.3: Wave-particle dualism, introductory quantum mechanics |
| 5 | 3,4 | 2 | 4.4-4.7: The uncertainty principle, the Bohr model<br>5.1-5.4: The one-dimensional Schrödinger equation, bound states<br>5.5-5.7: Bound states, applications<br>5.8-5.11: Expectation values, operators, nonstationary states, eigenvalues |
| 6 | 5 | 3<br>Lab session 1 | 6.1-6.2: Unbound states, potential step, barrier, tunnelling<br>6.3-6.4: Some applications, phase and group velocity, dispersion |
| 7,8 | 6<br>7(week 8) | 4<br>5(week 8)<br><br>Lab session 2 | 7.1-7.2: The three-dimensional Schrödinger equation, infinite well<br>7.3-7.9: The hydrogen atom and hydrogenlike atoms<br>8.1-8.2: Spin, identical particles |
| 9 | 8,9 | 6<br><br>Lab session 3 | 8.3-8.4: Many-electron systems, the periodic table<br>More about applications of quantum mechanics<br>(Material will be available on the course home page)<br>9.1-9.2: Thermodynamic system, entropy<br>9.3-9.4: Statistical mechanics, Maxwell-Boltzmann distribution<br>9.5-9.8: Fermi-Dirac- and Bose-Einstein distributions, laser |
| 10 | 10,11 | 7,8 | 10.1,10.4: Solid state physics,multiatom systems, crystalline solids<br>10.5: Energy bands<br>10.5-10.6: Conductor, semiconductor, insulator<br>10.7-10.8: Semiconductor theory, devices |
| 11 | | Lab session 4 | |

The following sections in Harris are included; some additional material will be available on the course home page (in Lisam).The chapters 2,3,4 in this outline are numbered 4,2,3 in the International Edition.

Chapter 1: All

Chapter 2: Sections 2.1 and 2.7

Chapter 3: All

Chapter 4: All

Chapter 5: All

Chapter 6: All except alpha decay in 6.3

Chapter 7: All except degeneracy (p 258) and 7.10

Chapter 8: Sections 8.1-8.4

Chapter 9: Sections 9.1, 9.2(except the discussion of temperature), 9.3-9.5, 9.6 (Bose-Einstein condensation is optional), 9.7 (the derivation in Appendix C that is referred to is optional), 9.8

Chapter 10: Sections 10.1, 10.4-10.8

In each chapter there is a final section entitled "Progress and Applications", with some examples of recent advances and interesting applications. These sections contain more than we have time to discuss in this course. If you want to read more yourself some links and references will be found on the course home page. Some additional material will be discussed in lectures 8 and 10-11.

## Problems in Harris:

You are suggested to start working on "A" problems, problems discussed in tutorials are underlined. Three problems will be discussed each tutorial.

Chapter 2: A: 73,75,83,97
B: 70,79,84,87,117

3: A: 17, 29,32,36,48
B: 19, 25, 30, 38, 41,52

4: A: 11, 20, 33, 37, 46, 61
B: 15,17,25,41,50,54,65

5: A: 28,35,60,61,66,69,80
B: 30, 40, 41, 45a-c,47,49a,64,81

6: A: 13, 15, 21, 33, 41,53
B: 18, 26,37,42,49

7: A: 18, 21,25,30,37,53,67,70
B: 20, 23, 33,35,45,49,56,58,71

8: A: 25, 28, 36, 41, 49, 84
B: 30,33,38,54

9: A: 19,22,27,37,41,43,61,62,66
B: Additional problems, homepage

10: A: 51, 52,56,57,58,63,64,66
B: Additional problems, homepage