Quantum Physics
PHY-215
Lecture Content

This is a short syllabus for the course with some references to the relevant chapters of "University Physics" by Young & Freedman. (You can find the same information in many other books). The points marked with **(r)** refer to topics you already studied in previous courses; in this case you only need to remember the very basic concepts that were recalled during the lectures. The points marked with * are slightly beyond the scope of this course; they will not appear in the final exam and are explained only to satisfy your curiosity.

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1. Review of classical mechanics: the concepts of point-particle, momentum, kinetic and potential energy. [**(r)** Chaps. 2–8].

2. The harmonic oscillator in classical mechanics. [**(r)** Chap. 13].

3. Review of relativistic kinematics. [**(r)** Chap. 37].
   Units of mass in terms of eV/c^2. [Chap. 23.2].

4. Kinetic theory of gases and heat capacities. [Chap. 18.3-18.4].

5. Sound is a wave. [Chap. 16.1].
   Wave mechanics. [Chap. 15, in particular Chap. 15.1–15.3].

6. Intensity and wave superposition. [Chap. 15.5–15.7].

7. Light is a wave [Chap. 32.6, 33.2].
   The blackbody radiation [Chap. 38.8].

8. Interference and Young's double slit experiment [Chap. 35.1–35.4].

9. Qualitative lecture. Facts that classical physics cannot explain: heat capacity of bi-atomic gases; atom stability and the result of Rutherford experiment [Chap. 38.4]; blackbody radiation; photoelectric effect.

10. The photoelectric effect: quantitative treatment [Chap. 38.2].

11. Millikan measurement of h. Planck's radiation law [Eq. 38.2].

12. X-ray production and Compton scattering [Chap. 38.7].

13. Wave/particle duality: de Broglie's waves [Chap. 39.1].

14. Quantization of angular momentum and Bohr's atomic model [Chap. 38.5].

15. The hydrogen spectrum from Bohr's model [Chap. 38.3].

16. The phenomenon of diffraction [Chap. 36.1–36.3].
17. More on diffraction: Bragg experiment [Chap. 36.5–36.6].
18. Electron diffraction and the Davisson Germer experiment [Chap. 39.2].
19. Heisenberg uncertainty principle [Chap 39.3].
20. Born's interpretation of the wave function [Chap. 39.5].
21. Beats, wave packets, phase and group velocities [Chap. 16.7, 39.5].
22. Schrödinger equation and stationary states [Chap. 39.5].
23. The postulates of Quantum Mechanics [*].
24. Particle in a 1-dimensional box [Chap. 40.1].
25. Particle in a 3-dimensional box, degeneracy and Pauli exclusion principle [Chap 40.5, 41.4].
26. The harmonic oscillator [Chap. 40.4].
27. Particle in a potential well [Chap. 40.2].
28. The atomic structure [*].
29. The specific heat of oxygen [*].