

**Sabanci University**  
**Faculty of Engineering and Natural Sciences**

**PHYS 211 Modern Physics**

**2023-2024 Spring**

**Instructor:** Ünal Ertan (Room: 1022, [unal@sabanciuniv.edu](mailto:unal@sabanciuniv.edu))

**Textbooks:**

Arthur Beiser, "Concepts of Modern Physics",

R. A. Serway, J. J. Moses, C. A. Moyer "Modern Physics"

**PHYS 211 COURSE OUTLINE**

**1. Special Relativity I**

- 1.1 Postulates of special relativity
- 1.2 Time dilation
- 1.3 Length contraction
- 1.4. The Lorentz transformation

**2. Special Relativity II**

- 2.1 Relativistic momentum
- 2.2 Relativistic energy
- 2.3 Conservation of relativistic momentum and energy

**3. The Quantum Theory of Light**

- 3.1 Electromagnetic waves
- 3.2 Blackbody radiation
- 3.3 Particle nature of light - photoelectric effect
- 3.4 Compton effect

**4. Atomic Structure**

- 4.1 Discovery of the electron
- 4.2 Rutherford experiment
- 4.3 Atomic spectra
- 4.4 The Bohr model of the hydrogen atom
- 4.5 Wave nature of matter - De Broglie
- 4.6 The Heisenberg uncertainty relation

**5. Quantum Mechanics**

- 5.1 Schrödinger equation
- 5.2 The particle in a box.
- 5.3. Expectation values
- 5.4 Tunneling
- 5.5 Hydrogen atom
- 5.6. Exclusion principle

**6. Fundamentals of statistical physics**

- 6.1 Maxwell Boltzmann distribution
- 6.2 indistinguishability and quantum statistics

## Grading:

Midterm 40 %

Final exam ..... 45 %

Homework ..... 15%

**Office hours:** Tuesday 9:40 -10:30

**- Questionnaires (10 %)** There will be 8 -12 (or more) questionnaires which are given in random lectures at random times. In these questionnaires, you are asked simple questions and/or the points that you did not understand in the current subject. This provides a feed-back for the instructor to clarify these points in the following lectures. This additional 10% could be considered as a bonus in your total grade. There won't be make up for the questionnaires that you fail to attend, even if you have reasonable excuses. To compensate for this, we do not count 3 of the questionnaires. For instance, if 12 questionnaires are given in a particular semester, those who attend 9 (or more) get full 10 %.

**If you miss an exam (MT or Final) for health reasons, you may take make-up exam (medical report approved by SU Health Center is required). The make-up exam covers all the chapters included in the course.**

Your total grade is converted into letter grade as follows:

85 - 100: A                      55 – 59: C

80 – 84: A-                      50 – 54: C-

75 – 79: B+                      45 – 49: D+

70 – 74: B                      40 – 44: D

65 – 69: B-                      < 40 : F

60 – 64: C

## Academic Integrity

In the exams each student will be evaluated only for her/his own work. Students are encouraged to work and study together. But what you put down on exam papers should be your own work in your own words. If your friends want to use of your paper in exams, assignments or quizzes, to allow this is not helping them. Such behavior, as all forms of cheating, is unfair and disrespectful, to yourself, to all the students in the class, to your teachers and teaching assistants, and to the university. A student involved in cheating has misused the trust extended to him or her. Violations of academic integrity will result in zero grades, both for those who cheat and those who allow and help them. These students may also face disciplinary action. In all such situations we will ask you to have a face-to-face meeting with your faculty member. We have mutual trust and respect for each other as individuals sharing in a collaborative learning experience. This is very valuable for all of us, and having to lose this trust and respect would be very regrettable.