Modern Physics (PHYS 213)

Spring 2026 (Term 252)

Schedule and Grading Policy

1) **Course Description** (Undergraduate bulletin)

Quantum theory of light; Particle nature of matter; Matter waves; Quantum mechanics in one and three dimensions; Tunneling phenomena; Atomic structure; Statistical Physics; Nuclear Structure.

Prerequisite: PHYS 102

3) **Textbook:** "Modern Physics", by Serway, Moses and Moyer, 3nd Edition, Brooks/Cole (2005).

4) **Supplementary Books/materials:**

(A) "Concepts of Modern Physics", A. Beiser, 6th Ed. McGraw-Hill (1994)
(B) "Modern Physics", Kenneth S. Krane, 4th Ed., Wiley (2019)
(C) https://www.youtube.com/watch?v=UTEUFihiAm0
(D) http://www.openculture.com/2014/12/animated-introductions-to-quantum-mechanics.html
(E) https://www.youtube.com/user/startalkradio
(F) PHYS 213 designated chatbot: https://chatgpt.com/g/g-695a9c2d6ee48191a9269eba5eb42681-phys-213-modern-physics

5) **Instructor:** Dr. Faris Almatouq

Bldg. 6, room 259-G

Office Hours: UTR: 12:00 ─ 12:50pm , W: 1:00 ─ 1:50pm

Email: faris@kfupm.edu.sa

6) **Assessments**

HW	**10%**
Quizzes	**10%**
Project	**10%**
Major Exam I	**20%**
Major Exam II	**20%**
Final Exam	**30%**
Total	**100%**

7) **Attendance:**

Attendance will be taken in each class, and students with more than 12 unexcused absences will be assigned a **DN** grade. A **W** grade will be given to the student who accumulates more than 18 absences (excused and unexcused). Homework should be submitted during the scheduled time in the class only, otherwise, the grade will be reduced.

Lecture Schedule

Week	Topics	Chapter	Section
1	Historical Overview **The Quantum Theory of Light**: Light as an EM wave Blackbody Radiation	--- 3 3	-- 1 2
2	The Rayleigh–Jeans Law and Planck's Law; Light Quantization and the Photoelectric Effect; The Compton Effect; Particle–Wave	3 3 3	3 4 5,6
3	**The Particle Nature of Matter**: Thompsons' and Millikan experiments; Rutherford model The Bohr Atom	4 4 4	1 2 3
4	Bohr's Correspondence Principle The Franck– Hertz Experiment **Matter Waves**; The Pilot Waves of De Broglie; The Davisson–Germer Experiment	4 4 5	4 5 1,2
5	Wave Groups and Dispersion The Heisenberg Uncertainty Principle If electrons are waves, What's Waving?	5 5 5	3 5 6
6	The Wave–Particle Duality **Quantum Mechanics in 1D**; Born interpretation Schrodinger wave equation	5 6 6	7 1,2 3
7	Particle in a box Finite square well The quantum oscillator	6 6 6	4 5 6
8	Expectation values; Observables and Operators **Tunneling**; The square barrier Barrier penetration	6 7 7	7,8 1 2
9	Applications **Quantum Mechanics in 3D**; Particle in a 3D box Central forces and angular momentum	7 8 8	2 1 2
10	Quantization of Angular momentum and energy The hydrogen atom **Atomic structure**-Zeeman Effect	8 8 9	3,4 5,6 1
11	The spinning Electron Spin-Orbit Interaction and the Exclusion Principle The Periodic Table; X-Ray Spectra & Moseley's Law	9 9 9	2 3,4 6,7
12	**Statistical Physics-** The Maxwell–Boltzmann Distribution Maxwell-Boltzmann Statistics Quantum Statistics	10 10 10	1 2 3
13	Applications of Bose-Einstein Statistics Fermi-Dirac Statistics **Nuclear Structure**; Nuclear Properties	10 10 13	4 5 1
14	Binding Energy and Nuclear Forces Radioactivity, Decay Processes Natural Radioactivity	13 13 13	2 4,5 6
15	**Nuclear Physics and Applications**; Nuclear Reaction Interactions involving neutrons; Nuclear Fission Nuclear Reactors; Nuclear Fusion	14 14 14	1,2 3,4 5,6
Major 1 (Ch 3 –5) & Major 2 (Ch 6–8) **Final Exam (Comprehensive)**			