COURSE SYLLABUS FORM

American University of Beirut
Faculty of Arts and Sciences

Department: **Physics**
Course Number and Title: **Phys 212, Modern Physics**

1. Course Learning Outcomes

The course introduces the basics of two great theories of the 20th century: Relativity Theory and Quantum Theory. After finishing this course, the students should be able to:

- Understand how the new ideas about spacetime required a radical revision of the Newtonian mechanics.
- Realize that one fundament of theory of special relativity is the invariance of the speed of light being independent of the inertial reference frames (IRF) , and this leads to the equivalence between mass and energy.
- Deal with Lorentz transformation connecting physical events in IRF in relative motion to each other.
- Comprehend the basic concept of quantum theory which describes the world at microscopic scale of the atoms and elementary particles.
- Become familiar with the Schroedinger equation as a basic equation of the quantum mechanics as Newton's second law is the basic of classical mechanics
- Solve the Schroedinger equation in simple cases and gets familiar with quantization of energy and angular momentum.
- Focus on different applications of the quantum theory: Structure of atoms, properties of radiation, Radioactivity, and basic description of the families of elementary particles.
- Appreciate the scientific revolution initiated by the development of modern physics in our societies.

2. Resources Available to Students

Main text book: Modern Physics
By K. S. Krane
Wiley, 1996, 2nd edition

Other text books : Modern Physics ?????
By Tipler ?????

Modern Physics
By Taylor & Zafiratos
Prentice Hall, 1991

3. Grading Criteria

4. Schedule

Week	Topic	Assignment
1	What is Relativity: Reference frames, Michelson-Morley Experiment of measuring speed of light.	Homework problems. Reading: More methods for measuring the speed of light
2	Postulates of the theory of special relativity, Time deliation, Length contraction, Lorentz Transformation, Addition of relativistic velocities, Doppler Effect	Homework problems
3	Relativistic Mechanics: Relativistic momentum, Relativistic energy, Equivalence of mass and energy, Massless particles , Comments on general relativity	Homework problems. Reading: How Einstein's thought experiments were done to justify the fundamental relation $E=M c^2$.
4 -5	Beginning of Quantum Mechanics Discovery of the electron, Rutherford scattering and the nuclear atom, Blackbody radiation, Photoelectric effect, Compton scattering, X-ray diffraction, Particle wave duality, Atomic Spectra	Homework problems
6	Operators in quantum Mechanics Schroedinger equation in one-dimension and applications	Homework problems
7	Schroedinger equation in three-dimensions and applications	Homework problems
8	Spin and angular momentum, Magnetic moments, Zeeman effect, Fine structure	Homework problems
9	Multi- electron atoms , Periodic Table Excited states of atoms	

10	Nuclear properties, Nuclear forces, Pauli principle and symmetry effects Shell model of nuclei	Homework problems
11-12	Radioactivity, Nuclear reactions, Beta decay, Fission, Fusion, Alpha decay	Homework problems
13-14	Introduction to Elementary Particles Pions and mesons, Leptons, Quark model of hadrons, Strong force and QCD, comments on Electro-Weak interaction	Homework problems

5. Course Policy

Comments on attendance , cheating excuse from exams