City University of Hong Kong
Course Syllabus

offered by Department of Physics
with effect from Semester B 2022/23

Part I Course Overview

Course Title:	**Modern Physics**
Course Code:	**PHY3202**
Course Duration:	**One semester**
Credit Units:	**3**
Level:	**B3**
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**(1) PHY1101 Introductory Classical Mechanics or AP1201/PHY1201 General Physics I or equivalent* (2) AP1202/PHY1202 General Physics II or equivalent* (3) AP1203/PHY1203 General Physics III or equivalent***
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**AP3202 Modern Physics**
Exclusive Courses: *(Course Code and Title)*	**AP3210/PHY3210 Modern Physics for Nuclear Technology**

*** This pre-requisite requirement is waived for Advanced Standing I students, Advanced Standing II students and GREAT students.**

Part II Course Details

1. Abstract

Understand the development, concepts and principles of Physics starting from the beginning of the 20th century. The two central areas are in relativity and quantum physics. Apply these concepts and principles to develop useful models of the atom, molecule, nucleus, and materials. Appreciate the limitations of these models. Appreciate the importance of experimental data for testing and developing modern physics.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs#	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Describe some important phenomena and principles in modern physics		√		
2.	Explain some specific phenomena observed using physics principles covered in the course.			√	
3.	Apply physics principles and mathematical methods in modern physics to analyze and solve basic problems in modern physics.			√	√
		100%			

** If weighting is assigned to CILOs, they should add up to 100%.*

 # Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.			Hours/week (if applicable)
		1	2	3	
Lectures	Explain basic concepts of quantum theory, theories of relativity, atomic physics and nuclear physics	√	√	√	2 hours/week
Tutorials	Apply physics principles and mathematical methods in modern physics to analyze and solve basic problems in modern physics.	√	√	√	1 hour/week
Laboratory	Practical experience with modern physics experiments	√	√	√	1 hour/week

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.			Weighting*	Remarks
	1	2	3		
Continuous Assessment: 50 %_					
Assignments	√	√	√	30%	
Laboratory reports		√		20%	
Examination^: 50% (duration: 2 hours)					
Examination	√	√	√	50%	
** The weightings should add up to 100%.*				100%	

^ For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	Demonstrated excellent understanding of the modern physics principles	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Laboratory reports	Ability to solve modern physics problems	High	Significant	Moderate	Basic	Not even reaching marginal level
3. Examination	Overall understanding of modern physics principles and concepts	High	Significant	Moderate	Basic	Not even reaching marginal level

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

- Special Relativity

  Basic principles, Michelson-Morley experiment, speed of light. Time dilation, length contraction and Relativity of simultaneity, Lorentz transformation. Relativistic mass energy, momentum.

- Concepts of general relativity

  Principle of equivalence, bending of space-time continuum, experimental evidences.

- Quantum Physics

  Wave-particle duality, double-slit experiment, uncertainty principle, atomic structure

- Molecules & solids

  Molecular bonds, molecular spectra, free electron theory in solids, band theory, electrical conduction, semiconductor devices, superconductivity

- Optical coherence & Lasers

  Young's interference, first and second order coherence, photon detection, Hanbury-Brown-Twiss experiment, quantum eraser, laser theory

- Nuclear structure

  Nuclear properties, nuclear models, radioactivity, decay law, radiation safety, fission and fusion, nuclear power, X-ray, neutron scattering

- Introduction to elementary particles

  Hadrons and Leptons, weak and strong interaction, quarks.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	A Beiser, Concepts of Modern Physics, McGraw-Hill (latest edition) The Open University; S271 Discovering Physics – Block C: units 12, 16.
2.	R A Serway, Physics for Scientists and Engineers, Saunders (latest edition). The Open University; S271 Discovering Physics – Block C: units 13, 14, and 15.
3.	Hugh D. Young and Roger A. Freedman, University Physics with Modern Physics, Addison-Wesley (13th Edition) 2011

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

Nil