City University of Hong Kong

Course Syllabus

offered by Department of Physics
with effect from Semester A 2018/19

Part I Course Overview

Course Title:	**Nuclear Radiation and Detection**
Course Code:	**PHY3206**
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)*	**Nil**
Precursors: *(Course Code and Title)*	**AP3202/PHY3202 Modern Physics**
Equivalent Courses: *(Course Code and Title)*	**AP3206 Nuclear Radiation and Detection** **AP3230/PHY3230 Nuclear Radiation and Measurements**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

Radiation technology is commonly used in science, industry and medical treatment nowadays. This course aims to lay down the foundation knowledge of nuclear radiation, its interactions with materials, and its detection and its applications in such a way that the students can identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

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.	***Explain*** the nature of nuclear decay and nuclear radiations.	20%	✓		
2.	***Analyse*** the interactions of radiation with matter.	35%		✓	
3.	***Apply*** theories to solve problems in radiation detection.	45%		✓	
		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	
Large Class Activities	Lecture and tutorials	✓	✓	✓	1.6 hours/week
Laboratory Work	Laboratory sessions, report writing, lab test	✓	✓	✓	1.4 hours/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%					
Mid-term tests	✓	✓	✓	25%	
Lab reports	✓	✓	✓	25%	
Examination^: 50% (duration: 2 hours)					
** 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. Mid-term Tests	The student can thoroughly identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.	High	Significant	Moderate	Basic	Not reaching marginal level
2. Lab Reports	The student attends all lab sessions, submits all lab reports, and completes a lab test, and demonstrates excellent understanding of the laboratory skills and the involved scientific principles.	High	Significant	Moderate	Basic	Not reaching marginal level
3. Examination	The student can thoroughly identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.	High	Significant	Moderate	Basic	Not reaching marginal level

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

1. Keyword Syllabus

- Basic concepts of nuclear physics
- Nuclear decay

  Half-life, serial transformations, Alpha decay, Alpha-particle spectra, Beta decay, Beta-particle spectra, Neutrino, Gamma decay, Gamma ray spectra.
- Interactions of radiation with matter

  Stopping power, Linear Energy Transfer, Range, Energy loss mechanisms
- Radiation detection systems

  Detector properties. Resolution, efficiency, dead-time. Pulse-height spectra. Detector types, gas-filled, scintillation and semiconductor devices.

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.	K S Krane, “Introductory Nuclear Physics”, Wiley (latest ed.).

2.2 Additional Readings

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

1.	J E Turner, “Atoms, Radiation and Radiation Protection”, Wiley (latest ed.)
2.	W E Burcham, “Elements of Nuclear Physics”, Longman (latest ed.)
3.	W H Tait, “Radiation Detection”, Butterworths (latest ed.)