**City University of Hong Kong**
**Course Syllabus**

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

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**Part I Course Overview**

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|---|---|
| **Course Title:** | **Radiation Safety** |
| **Course Code**: | **PHY4230** |
| **Course Duration:** | **One semester** |
| **Credit Units**: | **3** |
| **Level**: | **B4** |
| **Proposed Area:** *(for GE courses only)* | ☐ Arts and Humanities<br>☐ Study of Societies, Social and Business Organisations<br>☐ Science and Technology |
| **Medium of Instruction:** | **English** |
| **Medium of Assessment:** | **English** |
| **Prerequisites**: *(Course Code and Title)* | **Nil** |
| **Precursors**: *(Course Code and Title)* | **AP3230/PHY3230 Nuclear Radiation and Measurements**<br>**AP3275/PHY3275 Radiation Protection and Dosimetry** |
| **Equivalent Courses**: *(Course Code and Title)* | **AP4230 Radiation Safety** |
| **Exclusive Courses**: *(Course Code and Title)* | **AP4271/PHY4271 Environmental Radiation** |

## Part II Course Details

### 1. Abstract

This course aims to equip the students with knowledge for quantifying and characterizing the hazards of ionizing radiation and for protection against ionizing radiation.

### 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. | ***Evaluate*** radiation activity and doses. | | √ | √ | |
| 2. | ***Apply*** protection measures, ***appreciate*** recommended limits and safety issues on radiation. | | √ | √ | |
| 3. | ***Explain and appreciate*** ionizing radiation in the environment. | | √ | √ | |
| | | 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 | 4 | |
| Lectures | Explain the basic interaction mechanism of different radiations with matter, radiation shielding, and environment effects of radiation. | √ | √ | √ | | 2 hours/week |
| Tutorials | Problem solving related to radiation safety. | √ | √ | √ | | 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 | 4 | | |
| Continuous Assessment:50 % | | | | | | |
| Mid-term test | √ | √ | √ | √ | 30% | |
| Laboratory (2 experiments) | √ | √ | √ | √ | 10% | |
| Assignments | √ | √ | √ | √ | 10% | |
| 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.Assignments | Understanding problems related to radiation safety, particularly calculating radiation dose of different radiations, shieding thickness and penetration depth. | High | Significant | Moderate | Basic | Below marginal level |
| 2.Laboratory | Understanding the handling of radiation measuring equpiments and measuring the thickness of radiation shielding for alpha and beta radiations | High | Significant | Moderate | Basic | Below marginal level |
| 3.Mid-term test | Understanding the basic interaction mechanism of radiation with matter, understanding about radiation shielding, biological and environmental effects of radiations. | High | Significant | Moderate | Basic | Below marginal level |
| 4. Examination | Understanding the basic interaction mechanism of radiation with matter, understanding about radiation shielding, and environmental effects of radiations | High | Significant | Moderate | Basic | Below marginal level |

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

**1. Keyword Syllabus**

- Radiation fundamentals

  Types of radiation, source of radiation, atomic structure, nuclear structure, radioactivity

- Interaction of radiation with matter

  Charged particles, photons and neutrons

- Radiation dosimetry

  Measurement of exposure, absorbed dose, X-ray and gamma ray dose, neutron dosimetry, dose measurements of charged particle beam, personal dosimeters, internal dosimetry, dosimetric models

- Radiation protection and shielding

  Gamma-ray shielding, design of primary protective barrier, protection from beta radiation, neutron shielding.

- Ionizing radiation in the environment. Fallouts from nuclear reactors: Chernobyl, Three Mile Island, Fukushima

**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.)*

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|---|---|
| 1. | James E. Turner, Atom radiation and radiation protection, Wiley-VCH GmbH & Co. KGaA, 2012 |
| 2. | James E. Martin, Physics for Radiation Protection, Wiley-VCH GmbH & Co. KGaA, 2013 |
| 3. | Steve Forshier, Essential of radiation Biology and Protection, Delmar Cengage learning, 2009 |

**2.2 Additional Readings**

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

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|---|---|
| 1. | Claus Grupen, Introduction to radiation protection [electronic resource] : practical knowledge for handling radioactive sources. Berlin ; London : Springer, 2010. |
| 2. | Marilyn E. Noz, Gerald Q. Maguire, Jr., Radiation protection in the health sciences. World Scientific, c2007. |