

**City University of Hong Kong
Course Syllabus**

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

Part I Course Overview

Course Title: Environmental Physics

Course Code: PHY8527

Course Duration: 1 semester

Credit Units: 3

Level: R8

Medium of Instruction: English

Medium of Assessment: English

Prerequisites:
(Course Code and Title) Nil

Precursors:
(Course Code and Title) Nil

Equivalent Courses:
(Course Code and Title) Nil

Exclusive Courses:
(Course Code and Title) PHY6527 Environmental Physics

Part II Course Details

1. Abstract

Physics has always been concerned with understanding the phenomena in natural environment. Environmental physics is essential for tackling environmental problems accompanying economic development and maintaining a well-balanced relationship between human activities and natural environment. This course aims to provide students an introduction to environmental physics. The elements of the environment (e.g., gases, liquids, plants, and animals) and their physical properties (e.g., mass, temperature, transport) will be discussed. Emphasis will be put on heat transfer and the effects of various radiations including nuclear radiation on the environment. By the end of this course, students can gain necessary knowledge and skills to address real environmental challenges, such as developing safe and clean energy and dealing with the forecasted climate change.

2. Course Intended Learning Outcomes (CILOs)

| No. | CILOs | Weighting* (if applicable) | Discovery-enriched curriculum related learning outcomes (please tick where appropriate) | | |
|-----|---|-------------------------------|---|----|----|
| | | | A1 | A2 | A3 |
| 1. | Describe the physical properties of important elements in environment such as gases and liquids. | 20% | √ | | |
| 2. | Describe the transport properties of heat and mass | 20% | | √ | |
| 3. | Explain the effect of radiation on plants, animals, and humans | 20% | √ | | |
| 4. | Develop physical models to estimate various environmental effects | 20% | | √ | |
| 5. | Identify the challenges in developing clean energy, dealing with climate change, and pollutants reduction | 20% | | √ | |
| | | 100% | | | |

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)

| TLA | Brief Description | CILO No. | | | | | | Hours/week (if applicable) |
|-----|--------------------------------|----------|---|---|---|---|--|----------------------------|
| | | 1 | 2 | 3 | 4 | 5 | | |
| 1 | Lectures | √ | √ | √ | √ | √ | | 26 hrs/13 wks |
| 2 | Tutorials | √ | √ | √ | | | | 6 hrs/ 6 wks |
| 3 | Group project and presentation | | | | √ | √ | | 6 hrs/ 6 wks |

4. Assessment Tasks/Activities (ATs)

| Assessment Tasks/Activities | CILO No. | | | | | | Weighting* | Remarks |
|--------------------------------------|----------|---|---|---|---|--|------------|---------------|
| | 1 | 2 | 3 | 4 | 5 | | | |
| Continuous Assessment: 50% | | | | | | | | |
| Assignment | √ | √ | √ | √ | √ | | 10 | |
| Presentation | | | √ | √ | √ | | 20 | Group project |
| Report | | | √ | √ | √ | | 20 | Group project |
| Examination: 50% (duration: 2 hours) | | | | | | | | |
| Examination | √ | √ | √ | √ | | | 50 | |
| | | | | | | | 100% | |

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

| Assessment Task | Criterion | Excellent (A+, A, A-) | Good (B+, B) | Marginal (B-, C+, C) | Failure (F) |
|-----------------|---|--------------------------|-----------------|-------------------------|-----------------------------|
| 1. Assignment | Understanding important concepts in environmental physics; Ability to apply physics principles and models to estimate various environmental effects | High | Moderate | Basic | Not reaching marginal level |
| 2. Presentation | Understanding the mechanisms of selected environmental physics topic; Identify challenges and develop possible solutions | High | Moderate | Basic | Not reaching marginal level |
| 3. Report | Having an in-depth understanding of the physics related to selected environmental topic. | High | Moderate | Basic | Not reaching marginal level |
| 4. Examination | Ability of solving analytical problems in environmental physics | High | Moderate | Basic | Not reaching marginal level |

Applicable to students admitted before Semester A 2022/23

| Assessment Task | Criterion | Excellent (A+, A, A-) | Good (B+, B, B-) | Fair (C+, C, C-) | Marginal (D) | Failure (F) |
|-----------------|---|--------------------------|---------------------|---------------------|-----------------|-----------------------------|
| 1. Assignment | Understanding important concepts in environmental physics; Ability to apply physics principles and models to estimate various environmental effects | High | Significant | Moderate | Basic | Not reaching marginal level |

| | | | | | | |
|-----------------|--|------|-------------|----------|-------|-----------------------------|
| 2. Presentation | Understanding the mechanisms of selected environmental physics topic; Identify challenges and develop possible solutions | High | Significant | Moderate | Basic | Not reaching marginal level |
| 3. Report | Having an in-depth understanding of the physics related to selected environmental topic. | High | Significant | Moderate | Basic | Not reaching marginal level |
| 4. Examination | Ability of solving analytical problems in environmental physics | High | Significant | Moderate | Basic | Not reaching marginal level |

Part III Other Information

1. Keyword Syllabus

- Properties of gases and liquids
- Pressure, volume, temperature, the first law of thermodynamics, specific heat, latent heat, lapse rate, water vapor
- Water content and potential, stable isotopes
- Transport of heat and mass
- General transfer equation, molecular transfer processes, viscosity, heat and thermal conductivity, mass transfer and diffusivity, diffusion coefficients, diffusion of particles
- Radiation environment
- Absorption and emission of radiation, black body radiation, Planck's law, reflection and refraction, radiance and irradiance
- Solar radiation, spectrum of solar radiation, attenuation of solar radiation in the atmosphere, solar radiation at the ground
- Terrestrial radiation
- Microclimatology of radiation
- Radiative properties of natural materials (e.g., water, soils, metals, and animals)
- Radiation interception by solid structures, plant canopies, and animal coats
- Nuclear power
- Nuclear fission and fusion, relation between radiation and health (e.g., exposure to radiation, radiation from nuclear accidents, and health aspects of fusion)
- The fuel cycle, waste management
- Heat transfer
- Convection, conduction, insulation
- Steady state heat balance of water surfaces, soil and vegetation
- Steady state heat balance of animals
- Dynamics of climate system, human-induced climate change, greenhouse effect
- Mass transfer
- Gases and water vapor, ventilation, mass transfer through coats and clothing
- Particles, steady and non-steady motion, particle deposition and transport, dispersion of pollutants
- Turbulence

2. Reading List

2.1 Compulsory Readings

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|----|---|
| 1. | "Principles of Environmental Physics, Fourth Edition: Plants, Animals, and the Atmosphere", J. Monteith and M. Unsworth, Academic Press, 4 th ed., 2013. |
| 2. | "Environmental Physics: Sustainable Energy and Climate Change", E. Boeker and R. V. Grondelle, Wiley, 3 rd ed., 2011. |
| 3. | |
| 4. | |

2.2 Additional Readings

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