

# PHY6527: ENVIRONMENTAL PHYSICS

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## Effective Term

Semester B 2024/25

## Part I Course Overview

### Course Title

Environmental Physics

### Subject Code

PHY - Physics

### Course Number

6527

### Academic Unit

Physics (PHY)

### College/School

College of Science (SI)

### Course Duration

One Semester

### Credit Units

3

### Level

P5, P6 - Postgraduate Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

Nil

### Precursors

Nil

### Equivalent Courses

Nil

### Exclusive Courses

PHY8527 Environmental Physics

## Part II Course Details

### 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.

### Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 app.)		DEC-A2	DEC-A3
1	Describe the physical properties of important elements in environment such as gases and liquids.	20	x		
2	Describe the transport properties of heat and mass	20		x	
3	Explain the effect of radiation on plants, animals, and humans	20	x		
4	Develop physical models to estimate various environmental effects	20		x	
5	Identify the challenges in developing clean energy, dealing with climate change, and pollutants reduction	20		x	

#### 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 real-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.

### Learning and Teaching Activities (LTAs)

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

### Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignment	1, 2, 3, 4, 5	10	
2	Presentation	3, 4, 5	20	Group project
3	Report	3, 4, 5	20	Group project

**Continuous Assessment (%)**

50

**Examination (%)**

50

**Examination Duration (Hours)**

2

**Assessment Rubrics (AR)**

**Assessment Task**

Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Understanding important concepts in environmental physics; Ability to apply physics principles and models to estimate various environmental effects

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not reaching marginal level

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**Assessment Task**

Presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Understanding the mechanisms of selected environmental physics topic; Identify challenges and develop possible solutions

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not reaching marginal level

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**Assessment Task**

Report (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Having an in-depth understanding of the physics related to selected environmental topic

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not reaching marginal level

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**Assessment Task**

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Ability of solving analytical problems in environmental physics

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not reaching marginal level

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**Assessment Task**

Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Understanding important concepts in environmental physics; Ability to apply physics principles and models to estimate various environmental effects

**Excellent**

(A+, A, A-) High

**Good**

(B+, B) Moderate

**Marginal**

(B-, C+, C) Basic

**Failure**

(F) Not reaching marginal level

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**Assessment Task**

Presentation (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Understanding the mechanisms of selected environmental physics topic; Identify challenges and develop possible solutions

**Excellent**

(A+, A, A-) High

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(B+, B) Moderate

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(B-, C+, C) Basic

**Failure**

(F) Not reaching marginal level

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**Assessment Task**

Report (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Having an in-depth understanding of the physics related to selected environmental topic

**Excellent**

(A+, A, A-) High

**Good**

(B+, B) Moderate

**Marginal**

(B-, C+, C) Basic

**Failure**

(F) Not reaching marginal level

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**Assessment Task**

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Ability of solving analytical problems in environmental physics

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(B+, B) Moderate

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(B-, C+, C) Basic

**Failure**

(F) Not reaching marginal level

## Part III Other Information

### 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

### Reading List

#### Compulsory Readings

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

**Additional Readings**

	Title
1	Nil