

PHY3275: RADIATION PROTECTION AND DOSIMETRY

Effective Term

Semester A 2023/24

Part I Course Overview

Course Title

Radiation Protection and Dosimetry

Subject Code

PHY - Physics

Course Number

3275

Academic Unit

Physics (PHY)

College/School

College of Science (SI)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

AP3210/PHY3210 Modern Physics for Nuclear Technology

Precursors

Nil

Equivalent Courses

AP3275 Radiation Protection and Dosimetry

Exclusive Courses

AP4271/PHY4271 Environmental Radiation

Part II Course Details

Abstract

This course aims to lay down the foundation knowledge on radioactive decay, interaction of ionizing radiations with matter and human body, and protection against ionizing radiations.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Explain the nature of radioactive decay and ionizing radiations		x		
2	Analyse the interactions of ionizing radiations with matter and human body			x	
3	Apply protection measures against ionizing radiations			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.

Teaching and Learning Activities (TLAs)

TLAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Explain phenomena related to radioactive decay, interaction mechanisms of different ionizing radiations with matter and human body, and protection against ionizing radiations.	1, 2, 3	2 hours/week
2	Tutorials	Problem solving related to radiation protection and dosimetry	1, 2, 3	1 hour/week

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term tests	1, 2, 3	25	
2	Assignments	1, 2, 3	15	
3	Examination	1, 2, 3		

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

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

Assessment Rubrics (AR)

Assessment Task

1. Mid-term tests

Criterion

1.1 Ability to examine various characteristics of radioactive decay.

1.2 Ability to critically evaluate interaction of ionizing radiation with different matter and human body.

1.3 Ability to develop schemes for protection against ionizing radiation.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

Assessment Task

2. Assignments

Criterion

2.1 Ability to examine various characteristics of radioactive decay.

2.2 Ability to critically evaluate interaction of ionizing radiation with different matter and human body.

2.3 Ability to develop schemes for protection against ionizing radiation.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

Assessment Task

3. Examination

Criterion

3.1 Ability to examine various characteristics of radioactive decay.

3.2 Ability to critically evaluate interaction of ionizing radiation with different matter and human body.

3.3 Ability to develop schemes for protection against ionizing radiation.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

Part III Other Information

Keyword Syllabus

- Basic concepts of radioactive decay: alpha, beta and gamma decays; half life, activity, chain decay, secular and transient equilibrium
- Interaction of ionizing radiation with matter and human body
- Interactions of ionizing radiation with matter: collision loss, radiation loss, photoelectric effect, Compton scattering, pair production, attenuation, flux and intensity, solid angle; Interactions of ionizing radiation with human body: DNA damages breaks and chromosome aberrations caused by ionizing radiations, acute and late effects of ionizing radiations. Radiation doses.
- Protection against ionizing radiation
- Radiation shielding. Effective dose and equivalent dose limits. Exclusion and exemption. Protection of the embryo or fetus. de minimis dose and negligible individual dose.

Reading List**Compulsory Readings**

Title	
1	J Shapiro, "Radiation Protection" , Harvard University Press (latest ed.).
2	J R Lamarsh and A J Baratta "Introduction to Nuclear Engineering" , Prentice Hall (latest ed.).

Additional Readings

Title	
1	Nil