PHY3275: RADIATION PROTECTION AND DOSIMETRY

Effective Term
Semester A 2024/25

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 app.)	DEC-A1	DEC-A2	DEC-A3
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.

Learning and Teaching Activities (LTAs)

	LTAs	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

The student can thoroughly identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

Excellent (A+, A, A-)

The student can, at a high level, identify the appropriate concepts required in explaining and analysing given real-life situations.

Good (B+, B, B-)

The student can significantly identify the appropriate concepts required in explaining and analysing given real-life situations.

Fair (C+, C, C-)

The student can moderately identify the appropriate concepts required in explaining and analysing given real-life situations.

Marginal (D)

The student can, at a basic level, identify the appropriate concepts required in explaining and analysing given real-life situations.

Failure (F)

The student cannot, even at a basic level, identify the appropriate concepts required in explaining and analysing given real-life situations.

Assessment Task

2. Assignments

Criterion

The student can thoroughly identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

Excellent (A+, A, A-)

The student can, at a high level, explain and analyse observed phenomena both qualitatively and quantitatively.

Good (B+, B, B-)

The student can significantly explain and analyse observed phenomena both qualitatively and quantitatively.

Fair (C+, C, C-)

The student can moderately explain and analyse observed phenomena both qualitatively and quantitatively.

Marginal (D)

The student can, at a basic level, explain and analyse observed phenomena both qualitatively and quantitatively.

Failure (F)

The student cannot, even at a basic level, explain and analyse observed phenomena both qualitatively and quantitatively.

Assessment Task

3. Examination

Criterion

The student can thoroughly identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

Excellent (A+, A, A-)

The student can, at a high level, identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

Good (B+, B, B-)

The student can significantly identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

Fair (C+, C, C-)

The student can moderately identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

Marginal (D)

The student can, at a basic level, identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

Failure (F)

The student cannot, even at a basic level, identify the appropriate concepts required in given problems and apply them to formulate suitable solutions.

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