

PHY4274: RADIATION BIOPHYSICS

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Radiation Biophysics

Subject Code

PHY - Physics

Course Number

4274

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

Nil

Precursors

Nil

Equivalent Courses

AP4274 Radiation Biophysics

Exclusive Courses

Nil

Part II Course Details

Abstract

The present course aims to teach the students about the correlations of radiation physics and behavior of the human body. The course materials mainly cover the interactions of ionization radiation with cells and tissues in the human body, and clinical applications of ionizing radiation.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Describe and explain the interactions between ionizing radiation and the human body.		x		
2	Describe and model the survival of cells irradiated by ionizing radiation.		x		
3	Relate basic radiation biophysical principles to radiotherapy.			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	Including teaching of lecture materials, tutorial and problem solving sessions	1, 2, 3	2 hours/week
2	Tutorials	Questions and answers sessions, during which students will be asked questions and can ask questions, and there will be time for discussion. Numerical problems will also be given to the students to solve. If needed, the lecturer and/or TA will give information or hints to help the students solve the problems.	1, 2, 3	1 hour/week

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests	1, 2, 3	21	
2	Assignments	1, 2, 3	9	

Continuous Assessment (%)

30

Examination (%)

70

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. Tests

Criterion

The student can thoroughly describe and explain the interactions between ionizing radiation and the human body, describe and model the survival of cells irradiated by ionizing radiation, and relate basic radiation biophysical principles to radiotherapy.

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

The student can thoroughly describe and explain the interactions between ionizing radiation and the human body, describe and model the survival of cells irradiated by ionizing radiation, and relate basic radiation biophysical principles to radiotherapy.

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

The student can thoroughly describe and explain the interactions between ionizing radiation and the human body, describe and model the survival of cells irradiated by ionizing radiation, and relate basic radiation biophysical principles to radiotherapy.

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 radiation biophysics
Radiation doses, linear energy transfer, relative biologic effectiveness, oxygen enhancement ratio.
- Effects of ionizing radiation on the human body
Direct and indirect actions of ionizing radiations, DNA strand breaks and chromosome aberrations caused by ionizing radiations, acute and late effects of ionizing radiation
- Cell survival curve theory
Shape of survival curves, multi-target single-hit model, linear-quadratic model, other models.
- Basic radiotherapy physics
Fractionation in radiotherapy, fraction size and overall treatment time, effective doses in radiotherapy, modifiers.

Reading List

Compulsory Readings

Title	
1	Edward L Alpen “Radiation Biophysics” , Prentice-Hall Inc, NJ, USA, 1990.

Additional Readings

Title	
1	Nil