

# PHY4283: PHYSICS IN MEDICINE

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## Effective Term

Semester A 2022/23

## Part I Course Overview

### Course Title

Physics in Medicine

### Subject Code

PHY - Physics

### Course Number

4283

### 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

AP4283 Medical Physics I

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

Chemistry and biology are closely related to the modern medicine. Physics, however, seems to be difficult to communicate with this multifaceted discipline. The physics students rarely see the relationship between physics and medicine due to

the numbers of historical physics course materials that exclude the treatment of physics applied to medicine. The present course is to teach the students in a simple way in understanding the correlations of physics and behaviour of the human body. The aim of this course is to reestablish the importance of physics in medical discipline to the student. The course materials mainly cover the application of physics including temperature, light, sound, pressure, mechanics and electricity to medicine at elementary level.

### Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1 Identify and describe physics concepts applied to medicine.		x	x	
2 Describe and relate various principles of physics with the functioning of the skeletal, cardiovascular, hearing, visual, and central nervous systems.			x	
3 Reflect on the mechanics, heat transfer, energy balance, pressure balance, optics, and electromagnetism of the human body.			x	x
4 Apply physics of heat, sound, light and electromagnetism in medical technology.			x	x
5 Appreciate impact of artificial intelligence methods enhancing physics-based approaches in medicine.		x	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 Large class activities	Presentation of course material in class room	1, 2, 3, 4	
2 Tutorials	Reviewing recently graded assignments	1, 2, 3, 4	

### Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1 Assignments	1, 2, 3, 4	25	
2 Term project	2, 3, 4	20	

**Continuous Assessment (%)**

45

**Examination (%)**

55

**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. Exam

**Criterion**

The student can thoroughly identify and explain how the principles of physics are applied to solve medical / biomedical problems.

**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**

Understand the scientific principles and the working mechanisms. Identify and explain how the principles of physics are applied to solve medical / biomedical problems.

**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**

3. Term project

**Criterion**

Understand the scientific principles and the working mechanisms. Identify and explain how the principles of physics are applied to solve medical / biomedical problems.

**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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## Part III Other Information

### Keyword Syllabus

- Dynamic, static and frictional forces acting on and in the body
- Physical property of the human skeleton such as biomechanics, bone and bone articulate structure, and bone mineral density
- Concepts of thermometry and thermography and their clinical applications such as heat therapy and cryosurgery
- Energy consumption in the body, including the relationship between metabolic rate and body mass, oxygen consumption, and metabolic rate contribution in major internal organs, and the factors contributing to heat loss
- Physics in the lungs and breathing such as anatomy of the lung, breathing mechanism, the interaction between blood and gas pressure inside the lung as well as some common lung diseases
- Sound and its applications in medicine such as palpation and stethoscope
- The theory of ultrasound and its applications as a diagnostic tool
- The mechanism of phonation (production of speech)
- Anatomy of ear including outer ear, middle ear and inner ear, and sensitivity of the ear
- Hearing disabilities and theory of hearing aids
- Applications of visible light in medicine, infrared and ultraviolet light in medicine, lasers in medicine, applications of microscopes in medicine, and instruments used in ophthalmology
- Anatomy of eye, function of eye, mechanism of vision, defective vision and its correction, color vision and chromatic aberration
- Electromagnetism in the brain and heart, particularly related to action potential generation by neurons and myocytes
- Artificial intelligence methods and recent applications in medicine, including how AI enhances traditional physics-based approaches

## Reading List

### Compulsory Readings

Title	
1	Nil

### Additional Readings

Title	
1	Nil