City University of Hong Kong
Course Syllabus

offered by Department of Physics
with effect from Semester A 2022/23

Part I Course Overview

Course Title:	**Introduction to Biophysics**
Course Code:	**PHY8253**
Course Duration:	**One Semester**
Credit Units:	**3**
Level:	**R8**
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**NA**
Precursors: *(Course Code and Title)*	**NA**
Equivalent Courses: *(Course Code and Title)*	**NA**
Exclusive Courses: *(Course Code and Title)*	**PHY6253 Introduction to Biophysics**

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course will introduce students to the interdisciplinary field of biophysics. After a short introduction to basic molecular and cellular biology, we will cover several physics topics and their relevance to biology. They include diffusion theory (important in cellular behavior), thermodynamics (important in understanding large molecules like proteins), and three physics-inspired methods to study biology [X-ray crystallography, Cryogenic electron microscopy (Cryo-EM), and molecular dynamics simulations].

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Understand the chemical compositions and roles of DNAs, RNAs, and proteins in cells.	10	✓	✓	
2.	Understand diffusion theory and its relevance to cells.	20		✓	
3.	Understand thermodynamics and its relevance to biological macromolecule's structure and function.	30		✓	✓
4.	Understand relevant experimental and computational methods in Biophysics including X-ray crystallography, Cryo-EM, and molecular dynamics simulations.	20		✓	✓
5.	Practice researching the literature and giving academic presentations, or performing computer simulations and writing reports.	20			✓
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

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 self-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.

3. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5		
Lectures	Presentation of course material	0.3	0.6	0.9	0.6	0.6		3

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5			
Continuous Assessment: 50 %								
Assignments	✓	✓	✓	✓			20	
Presentation or Project	✓	✓	✓	✓	✓		30	Students can choose between (1) researching the literature and making a presentation, and (2) performing a computer-simulation project and submitting a report.
Examination: 50 % (duration: 2 hours, if applicable)								
** The weightings should add up to 100%.*							100%	

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignments	The student understands basic principles and can solve numerical problems.	High	Significant	Basic	Not reaching marginal level.
2. Presentation or Project	The student shows strong evidence of original thinking, and is able to communicate ideas effectively and persuasively via written texts or oral presentation.	High	Significant	Basic	Not reaching marginal level.
3. Examination	The student understands basic principles and can solve numerical problems.	High	Significant	Basic	Not reaching marginal level.

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	The student understands basic principles and can solve numerical problems.	High	Significant	Moderate	Basic	Not reaching marginal level
2. Presentation or Project	The student shows strong evidence of original thinking, and is able to communicate ideas effectively and persuasively via written texts or oral presentation.	High	Significant	Moderate	Basic	Not reaching marginal level
3. Examination	The student understands basic principles and can solve numerical problems.	High	Significant	Moderate	Basic	Not reaching marginal level

Part III Other Information

1. Keyword Syllabus

Biological macromolecules; including proteins, DNAs, and RNAs; and their role in cells.

Physical theories and relevant biological phenomena:

- Random walks, diffusion, and viscosity.
- Thermodynamics, entropic forces, and hydrophilic/hydrophobic interactions.
- Protein structure and function.

Methods to study biophysics:

- X-ray crystallography.
- Cryogenic electron microscopy.
- Molecular dynamics simulations.

2. Reading List

2.1 Compulsory Readings

1.	Lecture slides.

2.2 Additional Readings

1.	Biological Physics: Energy, Information, Life
2.	The Protein-Folding Problem, 50 Years On
3.	DeepMind's AI predicts structures for a vast trove of proteins
4.	The coming of age of de novo protein design
5.	How cryo-EM is revolutionizing structural biology
6.	Optical tweezers in single-molecule biophysics
7.	Liquid phase condensation in cell physiology and disease