# PHY1400: INTRODUCTORY PHYSICS FOR BIOLOGISTS

**Effective Term**
Semester A 2022/23

## Part I Course Overview

**Course Title**
Introductory Physics for Biologists

**Subject Code**
PHY - Physics
**Course Number**
1400

**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**
AP1400 Introductory Physics for Biologists

**Exclusive Courses**
GE1360 Introductory Physics

# Part II Course Details

**Abstract**

This course covers a wide scope of topics in physics relevant to medical and veterinary programs including biomechanics, heat, gases, wave and optics in both physiological and pathological contexts. Students will investigate the fundamentals of these topics and become able to apply them to achieve understanding of aspects of musculoskeletal functioning, thermoregulation, sensory perception and imaging technologies. This course equips students with a broad knowledge in several important topics in biophysics and the depth and coverage are sufficient for the students to pursue later studies in physiology, imaging technologies, pathology, and orthopaedic surgery.

**Course Intended Learning Outcomes (CILOs)**

| | CILOs | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|---|---|---|---|---|---|
| 1 | Recognize and use appropriately important technical terms and definitions relevant to the major topics in the course. | | x | | |
| 2 | Use appropriate mathematical notation to formulate and apply the physical laws covered in the course in concise form. | | x | | |
| 3 | Apply physics laws of mechanics, heat, gases, waves and optics in medical and veterinary situations. | | x | x | |
| 4 | Solve real and hypothetical problems by identifying the underlying physics and analyzing the problem. | | x | 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 | Lecture | Explain key concepts and theory of topics of the course | 1, 2, 3, 4 | 2 hrs/wk |
| 2 | Tutorial | Explain how some problems are solved and the techniques used; explain some concepts | 1, 2, 3, 4 | 1 hrs/wk |
| 3 | Assignment | Practice solving problems | 2, 3, 4 | |

| | | | | |
|---|---|---|---|---|
| 4 | Laboratory | Set up the experiment, carry out some measurement and analyse the results with the relevant theory; students learn experimental skills, analysis methods and data presentation skills | 3, 4 | 3 hours every third week |

**Assessment Tasks / Activities (ATs)**

| | ATs | CILO No. | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |
|---|---|---|---|---|
| 1 | Assignments | 1, 2, 3, 4 | 20 | |
| 2 | Laboratory reports | 1, 3, 4 | 10 | |

**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. Assignments

**Criterion**

1. Capacity for using physics knowledge and theory to solve biomedical problems
2. Demonstrate correct understanding of key concepts.

**Excellent (A+, A, A-)**

Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format

**Good (B+, B, B-)**

Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format

**Fair (C+, C, C-)**

Will exhibit a basic level of competence in understanding, explaining, and integrating the knowledge in written format

**Marginal (D)**

Will exhibit some deficiencies in understanding, explaining, and integrating the knowledge in written format

**Failure (F)**

Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format

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**Assessment Task**

2. Laboratory reports

**Criterion**

1. Demonstrate capacity of setting up the required experiments
2. Demonstrate capacity of carrying out proper measurement
3. Demonstrate correct understanding of the experimental results

**Excellent (A+, A, A-)**

Will exhibit a high level of understanding about experimental methods and the interpretation of results

**Good (B+, B, B-)**

Will exhibit a good level of understanding about experimental methods and the interpretation of results

**Fair (C+, C, C-)**

Will exhibit a basic level of understanding about experimental methods and the interpretation of results

**Marginal (D)**

Will exhibit some deficiencies in understanding about experimental methods and the interpretation of results

**Failure (F)**

Will exhibit lack of understanding about experimental methods and the interpretation of results

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**Assessment Task**

3. Examination

**Criterion**

1. Capacity for using physics knowledge and theory to solve biomedical problems
2. Demonstrate correct understanding of key concepts and physics theory.

**Excellent (A+, A, A-)**

Will exhibit a high level of competence in understanding, explaining, and integrating the knowledge in written format

**Good (B+, B, B-)**

Will exhibit a good level of competence in understanding, explaining, and integrating the knowledge in written format

**Fair (C+, C, C-)**

Will exhibit a basic level of competence in understanding, explaining, and integrating the knowledge in written format

**Marginal (D)**

Will exhibit some deficiencies in understanding, explaining, and integrating the knowledge in written format

**Failure (F)**

Will exhibit lack of competence in understanding, explaining, and integrating the knowledge in written format

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# Part III Other Information

**Keyword Syllabus**

- Mechanics: Vectors and scalars. Resolving forces. Newton’ s laws of motion. Conservation of energy. Moments and torques. Gravitation.
- Heat and gases: Temperature and heat. Heat capacity. Latent heat. Thermal expansion. Gas laws. Kinetic theory of gases.

- Waves: Traveling waves. Standing waves. Huygens' construction. Interference, refraction and diffraction. Doppler effect.
- Optics: Reflection. Refraction. Lenses. Impact of incident light intensity and sensor size. Leuckart's law.

**Reading List**

**Compulsory Readings**

| | Title |
|---|---|
| 1 | Nil |

**Additional Readings**

| | Title |
|---|---|
| 1 | Young, H. and Freedman, R. (2012) "University Physics with Modern Physics" 13th Edition. Pearson, San Francisco. |
| 2 | Knudson, D. (2007). Fundamentals of Biomechanics. Springer |
| 3 | College Physics in Openstax website: https://openstax.org/subjects/science |
| 4 | University Physics in Openstax website: https://openstax.org/subjects/science |