PHY2400: ADVANCED PHYSICS FOR BIOLOGISTS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Advanced Physics for Biologists

Subject Code
PHY - Physics
Course Number
2400

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
AP1400/PHY1400 Introductory Physics for Biologists

Precursors
Nil

Equivalent Courses
AP2400 Advanced Physics for Biologists

Exclusive Courses
Nil

Part II Course Details

Abstract

This course covers a range of topics in physics relevant to medical and veterinary programs including electricity, magnetism and atomic physics 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 neurotransmission, radiation and electrical pathologies 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, and pathology.

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 such as vector to formulate and apply the physical laws covered in the course in concise form.		x		
3	Apply physics laws of electricity, magnetism and atomic physics 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	2 hrs/wk
2	Tutorial	Explain how some problems are solved and the techniques used explain some concepts	1, 2, 3, 4	1 hr/wk
3	Assignments	Require students to solve real and hypothetical problems	1, 2, 3, 4	2hrs/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Homework Assignments	1, 2, 3, 4	30	
2	Quizzes	1, 2, 3, 4	10	

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. Homework 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. Quizzes

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
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

- Electrical properties: Polarity. Conduction of electricity in solids and liquids. Resistance and resistivity. Transfer of electrical energy.
- Electric fields: Coulomb’ s law. Field lines. Electric potential. Capacitors. Lightning.
- Magnetism: Field due to magnets and currents. Definition of B. Force on a wire carrying a current in a uniform magnetic field. Electromagnetic induction. Faraday’ s law. Lenz’ s law. Electromagnetic waves.
- Physics of fluid: density, pressure and buoyancy. Blood pressure.
- Modern physics: Photoelectric effects. Photons. Theories of the atom. Matter wave. Wave-particle duality. Basics of quantum mechanics. Atomic structure. Periodic table.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Young,H. and Freedman, R. (2015) “University Physics with Modern Physics” 14th Edition. Pearson, San Francisco.
2	Bushberg, J.T., Siebert, J.A., Leidholdt, E.M. and Boone, J.M. (2012). The essentials of medical imaging, 3rd edition. Wolters Kluwer, Philadelphia
3	Halliday, D., Resnick, R., and Walker, J. (2005). “Fundamentals of Physics” 9th Edition, Wiley