GE1305: FOUNDATION PHYSICS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Foundation Physics

Subject Code
GE - Gateway Education
Course Number
1305

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

GE Area (Primary)
Area 3 - Science and Technology

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
AP1200/PHY1200 Foundation Physics

Part II Course Details

Abstract

This course explores the fundamental principles of physics, focusing on the discipline's role in understanding the principles of physics and the laws of nature. Adopting a concept-focus approach introduces students to crucial physics concepts that enhance their understanding of the world and develop their well-informed opinions and choices in their professional careers and everyday lives. Students are also expected to learn in the course thinking skills of a physicist, which are evidence-based, critical and based on the framework of physical principles. The course will be run in a combination of lectures and tutorials with examples drawn from our everyday experience and important technologies. The students is assessed through an examination with conceptual questions (may require some simple calculations). The students can practice the use of concepts and principles to analyse physics phenomena or problems in tutorials. These tutorial questions are good training of the analytical skills used by physicists.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Cite and understand the basic concepts and principles of physics.		x		
2	Identify the relevant physics concepts and principles which play an important role in physical phenomena and relevant daily experience.		x	x	
3	Apply physics concepts and principles to analyse physical phenomena and relevant daily experience.				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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Describe and explain the examples, concepts and principles of physics	1, 2	26 hours in total
2	Video viewing	Students will watch video programmes on physics experiments or physics documentaries which prompt them to search scientific interpretations and explanation of the phenomena or issues.	1, 2	varies, during the lectures or tutorials

3	Tutorials	Students discuss with tutors on physics topics/ phenomena. The discussion trains the application of physics concepts and principles to analysis phenomena.	3	There is a total of five tutorials.

Additional Information for LTAs

During the lectures and tutorials, the following topics may be used to raise the interest of the students and lead the student to the relevant physics concepts and principles. These examples can also train the students to apply the concepts and principles to analyse the phenomena and operation principles. This list of topics is not exhaustive and other topics will be included if necessary:

1. Relation between your mobile phone and your microwave oven and production of food.
2. Where does the energy we use come from?
3. Why do you need to hold the hand rails in MTR?
4. Friction actually helps us to move. Without friction can we walk?
5. What does happen in boiling water?
6. Why do we use dry ice instead of ice to keep your ice cream cold?
7. Relation between LCD TV and your ice tea.
8. Why do grand pianos have the beautiful shape? What are the common components in a musical instrument?
9. Why do we need nuclear power plant?
10. How does radiotherapy cure cancer?
11. Quantum physics we use everyday.
12. Strange quantum world: a particle is not 100% a particle?
13. How can we create weightlessness on earth?
14. How is the laser show effect created? Its relation to internet communication.
15. How do LED light bulbs work and how do they save energy?
16. Why the universe is dark despite it has so many stars?
17. Why all the electrons are identical?
18. What is a black hole?
19. Why we need to build a huge collider to get the Higgs boson?
20. Other questions.

Possible video for viewing during class:

1. “Slow Motion Musical Instruments | Mister C (Slow Mo #14)” Youtube
2. “Energy for the future: the grand vision” (TJ163.2 .E547 2001 DVD)
3. “Renewable Energy” (TJ808 .R4723 2008 DVD)
4. “Law of Conservation of Energy (Roller Coaster Demo)” Youtube
5. “Electromagnetic Waves” Youtube
6. “Laser : the extraordinary light for material processing” (TA1677 .L3747 2000 DVD)
7. “Light Fantastic” (QC363 .L54 2007 DVD)
8. “Classic sound waves films” (QC225 .C537 2006 DVD)
9. “Hiroshima” (D767.25.H6 H568 2006 DVD)
10. Other videos “Particle Fever” Youtube
11. “Black Holes: the edge of all we know” Youtube
12. “A trip to infinity” Netflix

Assessment Tasks / Activities (ATs)

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

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

Demonstrate understanding of physics concepts and principles through their application to solve some conceptual problems.

Excellent (A+, A, A-)

Demonstrate a high level of understanding of physics concepts and principles through their application to solve some conceptual problems.

Good (B+, B, B-)

Demonstrate a significant level of understanding of physics concepts and principles through their application to solve some conceptual problems.

Fair (C+, C, C-)

Demonstrate a moderate level of understanding of physics concepts and principles through their application to solve some conceptual problems.

Marginal (D)

Demonstrate a basic level of understanding of physics concepts and principles through their application to solve some conceptual problems.

Failure (F)

Not able to demonstrate a basic level of understanding of physics concepts and principles through their application to solve some conceptual problems.

Assessment Task

2. Examination

Criterion

Demonstrate ability to understand the physics concepts and principles and apply the concepts and principles to analyze physical phenomena and solve some conceptual problems.

Excellent (A+, A, A-)

Demonstrate a high level of ability to understand the physics concepts and principles and apply the concepts and principles to analyze physical phenomena and solve some conceptual problems.

Good (B+, B, B-)

Demonstrate a significant level of ability to understand the physics concepts and principles and apply the concepts and principles to analyze physical phenomena and solve some conceptual problems.

Fair (C+, C, C-)

Demonstrate a moderate level of ability to understand the physics concepts and principles and apply the concepts and principles to analyze physical phenomena and solve some conceptual problems.

Marginal (D)

Demonstrate a basic level of ability to understand the physics concepts and principles and apply the concepts and principles to analyze physical phenomena and solve some conceptual problems.

Failure (F)

Not able to demonstrate a basic level of ability to understand the physics concepts and principles and apply the concepts and principles to analyze physical phenomena and solve some conceptual problems.

Part III Other Information

Keyword Syllabus

Newton’s Law of motion:
Velocity, Acceleration, Force,

Energy and Power:
Work done, Forms of Energy, Conservation of Energy, Electric Car, Diet or Exercise, Renewable energy

Atoms and Heat:
Building blocks of matter, Different Phases of Matter, Temperature and Thermal effects, Heat Engines and Refrigerators, Air Pressure

Gravity, Force and Space:
Gravitational force Launching rockets and Satellite, Solar system

Nuclei and Radioactivity:
Radioactivity, Seeing radiation, Radiation and death, Radiation to cure cancer, Environmental radioactivity, Fission, Fusion.

Chain Reactions, Nuclear Reactors and Atomic Bombs:
Various types of chain reactions, e.g. computer viruses, lightning and avalanches; Making a nuclear bomb, Nuclear Reactors and Daya Bay Nuclear Power Plant, Controlled fusion for power.

Electricity and Magnetism:
Charge and current, Finger sparks and lightning, magnets and compass, permanent magnets and electromagnets, magnetic recording, electric motors and generators, transformers, magnetic levitation, AC vs. DC.

Waves:
Sound waves, wave in a stretched string, water waves and tsunamis, earthquakes, music, superposition of waves, introduction to electromagnetic waves and quantum waves

Light:
Light and colour, EM wave fiber optics, photography and images, mirages, rainbows, mirrors and lenses, polarized light and 3-D movies, LCD displays.

Invisible light:
Light beyond the visible spectrum, Infrared and ultraviolet, night vision, remote sensing, weather satellites, sunburn and sunblock, the ozone layer and ozone depleting chemicals, other invisible ‘light’ including x-rays, gamma rays, radio waves and microwaves.

Quantum Physics:
'Particles are waves!’, Minimum unit of energy, Laser and DVD, Photoelectric effect and digital camera, Semiconductor and computer chips, Electron microscope, ‘Do you know your exact position?’ – Uncertainty Principle.

Particle Physics:

Fields, Interactions, Scale, Symmetry, Gauge, Phases, Matter, Standard Model

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	“Physics and Technology for Future Presidents – An Introduction to the Essential Physics Every World Leader Needs to Know”, Richard A. Muller, Princeton University Press, 2010.

Annex (for GE courses only)

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)

PILO 1: Demonstrate the capacity for self-directed learning

2, 3

PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology

1

PILO 3: Demonstrate critical thinking skills

2, 3

PILO 4: Interpret information and numerical data

2, 3

PILO 9: Value ethical and socially responsible actions

2

PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation

2, 3

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task

Examination and marks distribution.