

# PHY3210: MODERN PHYSICS FOR NUCLEAR TECHNOLOGY

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## Effective Term

Semester A 2025/26

## Part I Course Overview

### Course Title

Modern Physics for Nuclear Technology

### Subject Code

PHY - Physics

### Course Number

3210

### 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

PHY1101 Introductory Classical Mechanics or  
AP1201/PHY1201 General Physics I or equivalent

### Precursors

Nil

### Equivalent Courses

AP3210 Modern Physics for Nuclear Technology

### Exclusive Courses

AP3202/PHY3202 Modern Physics

## Part II Course Details

### Abstract

To prepare students of nuclear science and technology with a good foundation of modern physics. The two central areas of attention are in the physics of radiation and the atomic nucleus. As tools to aid the learning of these areas, electromagnetism, relativity and quantum physics are introduced.

### Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1 Describe important phenomena and principles in modern physics needed as a base to nuclear science and technology		x	x	x
2 Explain specific phenomena observed in nuclear science and technology using physics principles covered in the course.		x	x	x
3 Apply physical principles and mathematical methods learn in this course to analyze and solve basic problems in nuclear science and technology.		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.

### Learning and Teaching Activities (LTAs)

LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1 Lectures	Basic Theories and concepts	1, 2, 3	2 hours/ week
2 Tutorials	Additional experiments and exercises	1, 2, 3	10 hours/13 weeks
3 Laboratories	Demonstrations of principles	1, 2, 3	10 hours/13 weeks

### Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1 Mid-term test	1, 2, 3	30	-	Yes
2 Assignments	1, 2, 3	10	-	Yes
3 Lab Reports	1, 2, 3	10	-	Yes

### Continuous Assessment (%)

50

**Examination (%)**

50

**Examination Duration (Hours)**

2

**Minimum Continuous Assessment Passing Requirement (%)**

30

**Minimum Examination Passing Requirement (%)**

30

**Additional Information for ATs**

For a student to pass the course, at least 30%(30%) of the maximum mark for the examination (continuous assessment) must be obtained.

**Assessment Rubrics (AR)**

**Assessment Task**

1. Assignments

**Criterion**

The student completes all assessment task/activities and the work demonstrates excellent understanding of the scientific principles and the working mechanisms

**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**

2. Lab reports

**Criterion**

The student does the laboratory task and writes the report.

**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. Mid-term test

**Criterion**

The student can thoroughly identify and explain how the principles are applied to science and technology for solving physics and engineering 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**

4. Examination

**Criterion**

The student can thoroughly identify and explain how the principles are applied to science and technology for solving physics and engineering 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

- Electromagnetism  
Electric charges and Coulomb interaction; Electric field and potential; Charge movement and electric current; Magnetic field and magnetic forces; sources of magnetic field and electromagnetic induction; Electromagnetic waves.
- Special Relativity  
Basic principles, Michelson-Morley experiment, speed of light. Time dilation, length contraction and Relativity of simultaneity, Lorentz transformation. Relativistic mass energy, momentum.
- Radiation: Particles and waves  
Ultraviolet catastrophe and quantization; Photoelectric effect, Compton scattering, energy-mass relation, photon and its energy and momentum; De Broglie relation, and matter wave.
- X-rays and Atomic structure  
Rutherford scattering, Bohr model, quantum numbers, energy level, Schrodinger equation. Wavefunctions, quantum states, and quantum orbitals. Ground state and excited states, emission spectrum of molecules. Generation, X-ray spectra, characteristic lines, minimum wavelength, application of X-ray.
- Nucleus, nuclear power and irradiation damage  
Nuclear structure and properties, radioactivity, decay law, fission and fusion, nuclear power; irradiation damage..

### Reading List

#### Compulsory Readings

Title	
1	H.D. Young, Sears and Zemansky' s University Physics with Modern Physics Technology Update, Pearson (latest edition).

#### Additional Readings

Title	
1	J. Walker, Halliday and Resnick, Principles of Physics, Wiley (latest edition)