

AES-2022| Basic Atomic and Nuclear Physics Laboratory

Course Syllabus — Basic Atomic and Nuclear Physics Laboratory (AES-2022)

Credit Hours: 1 Credit hours

Co-requisites: Basic Atomic and Nuclear Physics (AES-2021)

QFE Level: 5

Knowledge: Comprehensive, specialized knowledge within a broad field of work or discipline, including an understanding of the underlying theoretical and abstract concepts with significant depth in some areas. A broad understanding of allied knowledge and theories in related fields of work or disciplines including related regulations, standards, codes, conventions and procedures. An understanding of information assembly, retrieval methods and logical problem-solving techniques from a range of sources. Recognition of sources of current knowledge and the integration of concepts from related fields. Literacy to comprehend and/or produce coherent texts covering complex relations from an array of information and contexts. Numeracy covering an array of mathematical procedures and representations and contexts.

Skills: Technical, creative and conceptual skills appropriate to solving a wide-range of problems associated with a field of work or discipline that include a comprehensive range of specialist cognitive and practical skills appropriate to diagnosing and implementing solutions to abstract, familiar and nonroutine problems within a field of work or discipline. Use of appropriate information retrieval methods and tools and techniques associated with the field of work or discipline.

Comprehensive communication and information technology skills to present, explain and/or critique complex matters. Literacy skills to comprehend and/or produce, from array of information, coherent texts covering complex relations. Numeracy skills to select, apply, reflect and communicate an array of mathematical procedures and representations and contexts

Competence:

Autonomy and responsibility: Can take responsibility for coordinating the implementation of appropriate approaches to complex work procedures and processes, resources or learning, including leading teams within a technical or paraprofessional activity. Can exercise coordination and/or supervision in routine, familiar and some nonroutine work or learning contexts. Can coordinate technical, design processes in routine, familiar, nonroutine and an array of contexts with support available, if required. Can express an internalized, personal world view, in the context of an understanding of socio-cultural relationships.

Role in context: Can function with autonomy in technical and coordination contexts and support paraprofessional roles under guidance can function both independently and in a coordination role with multiple groups. Can take responsibility for coordinating the development of individuals and groups. Can review and develop the performance of self and others.

Self-development: Can evaluate own learning and identify learning needs in a familiar environment. Can take responsibility for and plan own learning within a managed and nonroutine environment. Can comprehend and observe ethical standards.

Course Description

This Lab is an experimental course intended to complement Basic Atomic and Nuclear Physics (AES-2021) course. The purpose of the lab course is to explore some of the main concepts experimentally, which are covered in the course. Students will conduct, analyze and interpret experiments on radiation measurement using a GM tube individually or in teams. This course is to run alongside Basic Atomic and Nuclear Physics (AES-2021) course.

AES-2022| Basic Atomic and Nuclear Physics Laboratory

Instructors: TBD, TBD@adpoly.ac.ae

Schedule and Duration: The lab will start in the second week and meet for 15 teaching weeks at 2 hours/week.

Course Objectives

The overall objectives of this course are to

- State the safety procedures associated with conducting basic laboratory practical activities
- Prepare for laboratory practical activity according to advised procedure and determine type of report to produce
- Confirm radiation quantities and units to be utilized in the activity
- Confirm and retrieve the radiation measurement, monitoring and testing devices, equipment and instruments to be utilized
- Confirm the proformas for taking readings in the activity in accordance with requirements
- Perform functional checks and calibration of devices, equipment and instruments in accordance with established procedures
- Participate in practical activities involving a range of devices
- Predict the behavior and make measurements and tests of radiation sample materials and sources
- Relate physical observations and measurements involving radiation detection and measurements to recognized theories and principles
- Evaluate the accuracy of physical measurements and the potential sources of error in the measurements
- Produce laboratory reports that communicate findings of the experimental activities, in a logical and scientific manner.

Textbook

1. Lab manual.

Attendance

Sessions start on the hour. Students arriving after the session starts will be counted absent. Students will receive warnings and potential penalties from the Student Services Office or their sponsor if they reach 5%, 10%, and 15% absence. After 15% absence, students will receive a FA (fail due to absence) grade.

AES-2022| Basic Atomic and Nuclear Physics Laboratory

Academic Honesty Policy

Students must conduct their studies at AD Poly honestly, ethically, and in accordance with accepted standards of academic conduct. Any form of academic conduct which is contrary to these standards is academic misconduct, for which AD Poly may penalize the student.

Specifically, it is academic misconduct for a student to:

- Present copied, falsified, or improperly obtained data as if it were the result of laboratory work, field trips, or other investigatory work;
- Include in the student's individual work material which is the result of significant assistance from another person if that assistance was unacceptable according to the instructions or guidelines for that work;
- Cheat or attempt to cheat; or
- Plagiarize (knowingly presenting the work or property of another person as if it were one's own)

Abu Dhabi Polytechnic considers cheating or attempting to cheat a serious offense that will result in disciplinary action taken against involved individuals. Students caught cheating or attempting to cheat will earn an “F” grade in the course.

Course Learning Outcomes (CLOs)

Upon successful completion of the course a student should be able to:

CLO 1: Apply best practice in lab safety, including three-way communication

CLO 2: Write lab reports that adhere to high quality standards and meet submission deadlines

CLO 3: Participate in, and report on, radiation shop practical detection and measurements.

Course Topics

CT1: GM Plateau and optimum operating voltage

CT2: Background radiation measurements

CT3: Counting statistics

CT4: Resolving time and dead time of a GM counter

CT5: Efficiency of a GM tube

CT6: Inverse square law

CT7: Shelf ratios

CT8: Interaction of particles with matter

ABET Student Outcomes

The Higher Diploma in Nuclear Technology program student outcomes (SO) are taken from the 2019 ABET (Accreditation Board for Engineering and Technology) standard. Student Outcome 2 is from the associate degree standard and Student Outcomes 1, 3, 4, and 5 from the bachelor's degree standard.

AES-2022| Basic Atomic and Nuclear Physics Laboratory

- SO1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problems appropriate to the discipline;
- SO2. An ability to design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline;
- SO3. An ability to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;
- SO4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and
- SO5. An ability to function effectively as a member as well as a leader on technical teams.

Table 1: Relation Course Topics (CTs) to Course Learning Outcomes (CLOs)

	CT1	CT2	CT3	CT4	CT5	CT6	CT7	CT8
CLO1	H	H	H	H	H	H	H	H
CLO2	H	H	H	H	H	H	H	H
CLO3	H	H	H	H	H	H	H	H

H: High, M: Moderate, L: Low

Table 2: Relation Course Learning Outcomes (CLOs) to Students Outcomes (SOs*)

	SO1	SO2	SO3	SO4	SO5
CLO1					H
CLO2	L		H		M
CLO3	M	M	H	H	H

H: High, M: Moderate, L: Low

* SOs correspond to the ABET Student Outcomes (see above).

Week-by-Week Teaching Plan

Week	Experiment number	Experiment title	Text reference
2	1	Lecture on counting statistics and use of excel for data analysis	[1] Lab Manual
3	1	GM counter Plateau	
4	2	Background radiation measurements	[1] Lab Manual
5		Tutorial	
6	3	Counting Statistics	[1] Lab Manual
7		Tutorial	
8	4	Resolving time	[1] Lab Manual
9		Tutorial	
10	5	Efficiency of a GM tube	[1] Lab Manual
11		Tutorial	
12	6	Inverse Square law	[1] Lab Manual
13	7	Shelf ratios	[1] Lab Manual
14	8	Backscattering and Range of alpha particles	[1] Lab Manual
15		Preparation for exams	