Course Syllabus — Radiation Detection and Protection Laboratory (AES-2072)

Credit Hours: 1 Credit hours

Co-requisites: Radiation Detection and Protection (AES-2071)

QFE Level: 6

Knowledge: Specialized factual knowledge and an understanding of the boundaries in a field of work or discipline, encompassing a broad and coherent body of knowledge and concepts, with depth in the underlying understanding of the principles and concepts. An understanding of allied knowledge and theories in related fields of work or disciplines and in the case of paraprofessional respective discipline including related regulations, standards, codes, conventions. An understanding of critical approach and analysis, research approaches and methods and analytical problem-solving techniques from a range of sources familiarity with sources of current and existing knowledge and the integration of concepts from related fields. Literacy to comprehend and/or produce coherent texts, covering complex and/or diverse relations from a wide range of information. Numeracy covering a wide-range of mathematical procedures and representations used across a broad-range of contexts.

Skills: Specialist technical, creative and conceptual skills appropriate to solving complex problems associated with a field of work or discipline. A comprehensive range of specialist cognitive and practical skills appropriate to planning and implementing solutions to varied, unpredictable and unfamiliar problems within a field of work or discipline. Selection and use of appropriate research tools and strategies associated with the field of work or discipline. Advanced communication and information technology skills to present, explain and/or critique interdependent complex matters. Literacy skills to comprehend and/or produce, from a wide range of information, coherent texts covering complex and/or diverse relations. Numeracy skills to select, apply, assess and communicate a wide range of mathematical procedures and representations in a broad range of contexts.

Competence:

Autonomy and responsibility: Can take responsibility for developing appropriate approaches to managing complex work procedures and processes, resources or learning, including leading teams within a technical or professional activity with little support. Can supervise technical, supervisory or design processes in varied, unpredictable, unfamiliar and a broad range of contexts. Can work effectively as a specialist or in team leadership roles. Can express an internalized, personal world view, reflecting engagement in society at large and in sociocultural relationships.

Role in context: Can function with full autonomy in technical and supervisory contexts and adopt paraprofessional roles under guidance. Can take responsibility for the setting and achievement of group outcomes and for the supervision of the work of others. Can take responsibility for supervising the development of individuals and groups. Can participate in peer relationships with qualified practitioners and lead multiple groups.

Self-development: Can evaluate own learning and identify learning weaknesses and needs, in a familiar and unfamiliar environment. Can take initiative to address learning needs and function independently and within learning groups. Can support and observe ethical standards.

Course Description

This Lab is an experimental course intended to complement Radiation Detection and Protection (AES-2071) 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 counting, energy calibration, gamma spectra measurements, detector resolution, Compton scattering, Pair production and annihilation and absorption of gammas by different

materials individually or in teams. This course is to run alongside Radiation Detection and Protection (AES-2071).

Instructors: TBD, TBD@adpoly.ac.ae

Schedule and Duration: 15 weeks plus examination week; lecture: 2 hours/week; (1 Credit Hours)

Course Objectives

The overall objectives of this course are to

- State the safety procedures associated with conducting basic laboratory practical activities in the laboratory
- 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 behaviour 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.

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: Conduct experiments on radiation detection and measurements.

Course Topics

CT1: Radiation detection and measurement. Counting Statistics

CT2: Radiation detection and measurement. Energy Calibration

CT3: Radiation detection and measurement. Detector resolution and Efficiency

CT4: Radiation detection and measurement. Gamma spectroscopy.

CT5: Radiation protection. Interaction of photons and electrons with matter.

CT6: Radiation protection: Alpha and Beta particle energy measurement.

CT7: Radiation protection: General area survey

CT8: Radiation protection. Shielding, distance and time.

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.

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		L		M		M	M	M
CLO2	M	M	M	M	M	M	M	M
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	H
CLO2			H		
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	Counting Statistics	[1] Lab Manual
3		Tutorial	
4	2	Energy Calibration	[1] Lab Manual
5		Tutorial	
6	3	Detector Resolution	[1] Lab Manual
7		Tutorial	
8	4	Compton Scattering	[1] Lab Manual
9		Tutorial	
10	5	Photon absorption	[1] Lab Manual
11		Tutorial	
12	6	Maximum Beta particle energy	[1] Lab Manual
13	7	Inverse Square law	
14	8	Absorption of electrons	[1] Lab Manual
15		Preparation for exams	