Course Specification
(Bachelor)

Course Title:	Nuclear Physics Lab
Course Code:	0452
Program:	Physics
Department:	Physics
College:	College of Science
Institution:	Majmaah University
Version:	1
Last Revision Date:	30/12/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 2(0+4+0)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: ((7th level/4th Year)					
4. Course General Description:					
This course aims to familiarize students with the experimental aspect of some concepts introduced in Nuclear Physics: mean lifetime, radioactivity, and passage of radiation through matter. The students will learn the principles and techniques of nuclear radiation detection and familiarize themselves with some electronic amplification and signal processing, data acquisition techniques, and statistical uncertainties. Finally, students will learn how to write a scientific report and prepare a scientific presentation.					
5. Pre-requirements for this course (if any)**:**					
PHYS 0351					
6. Co-requisites for this course (if any)**:**					
None					
7. Course Main Objective(s):					
1. Develop a clear understanding of experimental aspects of some concepts in nuclear physics. 2. Acquire knowledge of natural radioactivity and various decay modes. 3. Be familiar with the different types of nuclear reactions and nuclear detectors.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	64	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours

1.	**Lectures**	
2.	**Laboratory/Studio**	64
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		64

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Design and plan a measurement involving nuclear or natural radiation	K1	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
1.2	Match the type of detector to the intended measurement process	K2	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
1.3	Tune parameters of a nuclear electronic equipment	K1	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
1.4	Calibrate a radiation detector	K2	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
1.5	Measure and subtract noise and natural background	K2	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
1.6	Operate a data acquisition system, collecting thousands of data points	K1, K2	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
1.7	Analyse the experimental data, to produce graphics	K1, K2	Introductory Lecture Experiment	Lab report Observation Presentation Exam

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	showing both statistical and systematic errors, and fits to theoretical models		manual	
1.8	Interpret the experimental outcome, make a critical assessment and draw valid conclusions by comparing the measured values with previous measurements	K1, K2	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
1.9	Prepare a detailed written scientific report, both individually and within a team	K1, K2	Introductory Lecture Experiment manual	Lab report Observation Presentation Exam
2.0	**Skills**			
2.1	Apply CASSY Lab software for the data analysis.	S1	Introductory Lecture -Exercises	Lab report Observation Presentation Exam
2.2	Apply the gained mathematical and experimental knowledge in any physical phenomena to understand its behavior.	S3	Introductory Lecture -Exercises	Lab report Observation Presentation Exam
...				
3.0	**Values, autonomy, and responsibility**			
3.1	To develop the teamwork skills necessary to perform effectively.	V1	Lectures	Lab report Observation Presentation Exam
3.2	To develop the ability to argue scientifically with the instructor.	V1	Lectures	Lab report Observation Presentation Exam

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.3	To know how to use the computer program to analyze the data, and make some simulation	V1	Lectures	Lab report Observation Presentation Exam

C. Course Content

No	List of Topics	Contact Hours
1	Introduction and instructions about the laboratory	4
2	Compton Scattering	4
3	Counting statistics (Bose statistics)/ Poisson Distribution	4
4	Half-life time measurements of a ^{137}Ba using a digital counter and PC	4
5	β absorption using NaI detector / Recording beta spectrum with a scintillation counter	4
6	γ absorption using NaI Detector	4
7	Gamma-ray Spectroscopy using a scintillation detector / Detecting γ radiation with a scintillation counter	6
8	Rutherford Scattering	6
9	Alpha particle spectroscopy	6
10	Determining the energy loss of alpha particles in Al and Au	6
11	Nuclear magnetic resonance	4
12	Law of distance and absorption of gamma or beta using Geiger counter	4
13	Inverse square law for γ rays	4
14	Radioactivity measurement: K-40 spectrum	4
Total		64

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Lab. Reports	Weekly	30%
2.	Observation (In-lab.)	Weekly	20%
3.	Presentation	Once	10%
4.	Final Practical Exam	15	40%
5.	Total		100%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Introductory Nuclear Physics, K.S. Krane, 2nd edition, John Wiley and Sons, 1988. Radiation Detection and Measurement, G.F. Knoll, 4th Edition, 2010.
Supportive References	Lab Manuals, Lab manual book.
Electronic Materials	• Saudi Digital Library (SDL) • https://www.wikipedia.org/ • Web of Knowledge • Physics Today (web version) • MIT Courseware • www.eagle.co.uk/news/ppnews.html • http://faculty.mu.edu.sa/mskhan • http://vlib.org/physics.html • http://dir.yahoo.com/science/physics • http://demonstrations.wolfram.com • http://askthephysicist.com • http:// cyberphysics.co.uk • www.id-didactic.com
Other Learning Materials	Excel software for plotting graphs. MS Office for writing reports and presentations.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Laboratories with at least 25 seats. Auditorium of a capacity of not less than 100 seats for large lecture format classes.
Technology equipment (projector, smart board, software)	A smart board to write on a computer.
Other equipment (depending on the nature of the specialty)	Library, Seminar Room, and Wi-Fi internet connections.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Internal Reviewer committee	Direct
Effectiveness of Students assessment	Students	indirect
Quality of learning resources	Qiyas center, stockholder, and others	Direct
The extent to which CLOs have been achieved	Peer Reviewer	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	**16**
DATE	**30/12/2024**