Course Specification

(Postgraduate Programs)

Course Title:	**Experimental Methods in Radiation Physics**
Course Code:	**PHY 6283**
Program:	**Master of Science in Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	**3**
Last Revision Date:	***26/09/2024***

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A. General information about the course:

1. Course Identification:

1. Credit hours: 3

2. Course type

A.	☐ University	☐ College	☒ Department	☐ Track
B.	☐ Required		☒ Elective	

3. Level/year at which this course is offered: Level 3 or 4/Year 2

4. Course General Description:

This course provides the basic concepts of the instruments and techniques important in the detection and spectroscopy of ionizing radiation, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.

5. Pre-requirements for this course (if any): None

6. Pre-requirements for this course (if any): None

7. Course Main Objective(s):

At the end of this course, students will be able to:

- **Understanding of the instruments and techniques important in the detection and spectroscopy of ionizing radiation.**
- **Evaluate and compare the radiation instrumentation methods.**
- **Improve the ability to evaluate measurement systems for different applications.**
- **Understand the applicability and limitations of all major types of detectors.**
- **Gain a thorough understanding of gamma and neutron spectroscopy and the systems used in multichannel analysis.**
- **Describe the laboratory experiments concisely present and analyze results, including experimental, calculated, and propagated uncertainties, and draw conclusions based on the results, and make oral presentations to the class.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	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**	**15**
2.	**Laboratory/Studio**	**30**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify)……**	**0**
	Total	**75**

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	**State the techniques applicable to their own research experiment in Radiation detection and/or instrumentation.**	**K1,K3**	• Lectures. • Tutorials. Class discussions.	▪ Exams. ▪ Participation. Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	**Describe and interpret experimental data pertaining to radiation detection.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**State the fundamental processes involved with the interaction of X- and gamma-ray photons, charged particles and neutrons with matter.**	**K1,K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Describe the basic evaluation of experimental data using standard statistical methods.**	**K2, K3**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying Experimental Methods in Radiation Physics.**	**S1, S2**	• Lectures. • Class discussions. • Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Develop the students ability to solve and analyze problems in physics related the topics covered by the course.**	**S2, S3**	• Problem classes and group tutorial. • Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. Homework.
2.3	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**	**S3, S4**	• Lectures. • Class discussions. • Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ Exams. ▪ Participation and activities of students in the course community and blackboard. ▪ Homework.
3.0	**Values, autonomy, and responsibility**			
3.1	**Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.**	**V1, V2, V3**	• Small team tasks • Open discussion at classroom. • Office hours.	▪ Participation ▪ Homework. ▪ Mini-project(s).

C. Course Content:

No	List of Topics	Contact Hours
1.	Determination of half-value thickness and linear attenuation coefficient of porous media. Verification of inverse square law.	10
2.	Determination of plateau and resolving time of a GM counter and its application in measurement of beta source activity. Study the range of beta particles measurement.	10
3.	Study of voltage and current characteristics of an ion chamber.	10
4.	Calibration check of survey instrument and pocket dosimeters. Statistics of radioactive counting.	8
5.	Calibration TL phosphor & TLD reader and its use in dose distribution measurements. Calibration of TLD personnel monitoring badge, dose evaluation and risk estimate.	8
6.	Characteristics of a flow counter and beta activity measurement.	8
7.	Determination of percentage depth dose of high energy photon beams and electron beams.	8
8.	Preparation and standardization of sealed sources/unsealed sources. Study of linearity of dose monitoring system of linear accelerator.	8
9.	Quality assurance test procedures of radiation physics.	5
Total		75

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Class Activities (class quizzes, homework, solving problems, etc.....)	weekly	20 %
2.	Midterm Exam 1	6th week	20 %
3.	Midterm Exam 2	12th week	20 %
4.	Final Exam	16th week	40 %

*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	
Supportive References	-G.F. Knoll. Radiation Detection and Measurement, 4th Edition, John Wiley & Sons, 2012. -G.R. Gilmore, Practical Gamma-ray Spectrometry, 2nd Edition, John Wiley & Sons, Ltd., 2008.
Electronic Materials	https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx
Other Learning Materials	Multimedia associated with the textbook and the relevant websites.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms - Ball milling, Sol-gel, XRD VSM, SEM/EDAX research Lab
Technology equipment (Projector, smart board, software)	- Classroom equipped with a whiteboard and a projector.
Other equipment (Depending on the nature of the specialty)	

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	- Students. - Second examiner	Indirect (The student will complete evaluation forms at the end of semester. Final exam is evaluated by the second examiner)
Effectiveness of students' assessment	- Instructors	Direct (exams, HW, project, ...)
Quality of learning resources	- Faculty - Students	Indirect (surveys)
The extent to which CLOs have been achieved	- Instructors - Program Leaders	Direct (excel sheet)
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Quality Unit-Physics Department
REFERENCE NO.	Department council No. 6
DATE	26/09/2024