Course Specification

(Postgraduate Programs)

Course Title:	Radiological Mathematics
Course Code:	PHY 6275
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 is intended to develop and apply the measurement related to Radiation Physics, Nature of Counting Distributions, Binomial Distribution, Poisson Distribution, Normal Distribution, Mean and Standard Deviation of a Set of Measurements. The course starts with Units of measurement and Detection and Uncertainty for Gamma Spectroscopy and discussed the levels of Detection, Critical Level, Detection Limit (Ld) or Lower Level of Detection (LLD), Minimum Detectable Concentration or Contamination, Minimum Detectable Concentration (MDConc.), Minimum Detectable Contamination (MDCont.), Less-than Level (Lt), Interpretations and Restrictions, Log Normal Data Distributions, Particle Size 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:

- **Learn and understand the statistical world of atoms and radiation.**
- **Become familiar with methods or radiation measurement.**
- **Understand and apply counting statistics models and error propagation.**
- **Learn to calculate detection limits and other quantities related to radiation measurements, radiation exposure and perform associated risk analysis.**
- **Learn about the methods and approaches for implementation of a radiation protection program.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	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**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify).....**	**0**
	Total	**60**

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	**Interpret probabilities and rates in radiation physics.**	**K1**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the statistics in radiation physics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the methods of radiation measurement.**	**K2,K3**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.4	**Describe the counting statistics models and error propagation.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying Radiological Mathematics course.**	**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.	**Units of measurement related to Radiation Physics, Nature of Counting Distributions, Binomial Distribution, Poisson Distribution,**	**12**

	Normal Distribution, Mean and Standard Deviation of a Set of Measurements.	
2.	Uncertainty in the Activity of a Radioactive Source, Uncertainty in a Single Measurement, Propagation of Error.	12
3.	Statistical Subtraction of a Background Count or Count Rate, Error Propagation of Several Uncertain Parameters, Comparison of Data Sets, Are Two Measurements Different, Statistics for the Counting Laboratory, Uncertainty of a Radioactivity Measurement, Determining a Count Time, Efficient Distribution of Counting Time.	12
4.	Detection and Uncertainty for Gamma Spectroscopy, Testing the Distribution of a Series of Counts, the Chi-square Statistic, Weighted Sample Mean, Rejection of Data.	12
5.	Levels of Detection, Critical Level, Detection Limit (Ld) or Lower Level of Detection (LLD), Minimum Detectable Concentration or Contamination, Minimum Detectable Concentration (MDConc.), Minimum Detectable Contamination (MDCont.), Less-than Level (Lt), Interpretations and Restrictions, Log Normal Data Distributions, Particle Size Analysis.	12
Total		60

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	6thweek	20 %
3.	Midterm Exam 2	12thweek	20 %
4.	Final Exam	16thweek	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	*-J.E. Martin, Physics for Radiation Protection, 2nd Edition, Wiely-VCH, 2006.* *-J.E. Turner, Atoms, Radiation, and Radiation Protection, 3rd Edition, Wiley-VCH Verlag GmbH & Co., KGaA, Weinheim, 2007.*
Supportive References	*-G.F. Knoll. Radiation Detection and Measurement, 4th Edition, John Wiley & Sons, 2012*
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 -
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