Course Specification

(Postgraduate Programs)

Course Title:	Radiation Protection and Dosimetry
Course Code:	PHY 6277
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 offers professionals and advanced students a comprehensive coverage of the principal concepts upon which radiation protection and dosimetry are based and presents methods for their practical utilization and calculations. Basic principles and procedures that are used in radiation dosimetry, radiation shielding and radiation protection are illustrated with an abundance of worked examples that exemplify practical applications and statistical interpretations.

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:

- **Understand the physical, chemical and biological effects of radiation.**
- **Learn the radiation protection standards, guidelines and recommendations.**
- **Become familiar with the type of instrumentation used in radiation measurement and protection.**
- **Understand the elements of radiation exposure, protection and shielding.**
- **Differentiate between various radiation sources, exposure, pathways and their related risks.**
- **Learn to calculate 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	**Discuss the concepts of atomic and nuclear physics for radiation protection and dosimetry.**	**K1**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the interaction of ionizing radiation and neutrons with matter and ability to apply this knowledge to practical problems.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	**Interpret the concepts of external radiation dosimetry.**	**K1**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Recognize the concepts of internal radiation dosimetry to practical problems.**	**K2, K3**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying Radiation Protection and Dosimetry**	**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.	Radiation Dosimetry: Quantities and units, Exposure, Absorbed dose, Dose equivalent, Measurement of exposure, Free-air ionization chamber, The air-wall chamber, Measurement of absorbed dose, Measurement of x- and gamma-ray dose, Neutron dosimetry, Dose measurements for charged-particle beams, Determination of LET, Dose calculations, Alpha and low-energy Beta emitters distributed in tissue, Charged-particle beams, Point source of gamma rays, Neutrons, Other dosimetricconcepts and quantities, Kerma, Microdosimetry, Specific energy, Lineal energy.	12
2.	Chemical and Biological Effects of Radiation: Time frame for radiation effects, Physical and prechemicalchances in irradiated water, Chemical stage, Examples of calculated charged-particle tracks in water, Chemical yields in water, Biological effects, Sources of human data, The life span study, Medical radiation, Radium-dial painters, Uranium miners, Accidents, The acute radiation syndrome, Delayed somatic effects, Cancer, Life shortening, Cataracts, Irradiation of mammalian embryo and fetus, Genetic effects, Radiation biology, Dose–response relationships, Factors affecting dose response, Relative biological effectiveness, Dose rate, Oxygen enhancement ratio, Chemical modifiers, Dose fractionation and radiotherapy.	12
3.	Radiation-Protection Criteria and Exposure Limits: Objective of radiation protection, Elements of radiation-protection programs, The NCRP and ICRP, NCRP/ICRP dosimetricquantities, Equivalent dose, Effective dose, Committed equivalent dose, Committed effective dose, Collective quantities, Limits on intake, Risk estimates for radiation protection, Current exposure limits of the NCRP and ICRP, Occupational limits, Nonoccupational limits, Negligible individual dose, Exposure of individuals under 18 years of age, Occupational limits in the dose-equivalent system, The “2007 ICRP recommendations”, ICRU operational quantities, Probability of causation.	12
4.	External Radiation Protection: Distance, Time and shielding, Gamma-ray shielding, Shielding in X-Ray installations, Design of primary protective barrier, Design of secondary protective barrier, NCRP report No. 147, Protection from beta radiation, Neutron shielding.	12
5.	Internal Dosimetry and Radiation Protection: ICRP publication 89, Methodology, ICRP-30 dosimetricmodel for the respiratory system, ICRP-66 human respiratory tract model, ICRP-30 dosimetricmodel for the gastrointestinal tract, Organ activities as functions of time, Specific absorbed fraction, Specific effective energy and committed quantities, Number of transformations in source organs over 50 Y, Dosimetricmodel for bone, ICRP-30 dosimetricmodel for submersion in a radioactive gas cloud, Selected ICRP-30 metabolic data for reference man.	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. Turner, Atoms, Radiation, and Radiation Protection, 3rd Edition, Wiley-VCH Verlag GmbH & Co., KGaA, Weinheim, 2007.*
Supportive References	*-E.B. Podgorsak. Radiation Physics for Medical Physicists, Springer, 2006.*
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)

Assessment Areas/Issues	Assessor	Assessment Methods
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