Course Specification
(Bachelor)

Course Title	**Introduction to Radiation Physics**
Course Code:	**PHY 1469**
Program:	**Bachelor of Science in Physics.**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	1
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	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (Level 7 or 8/ Year4)					
4. Course General Description:					
This course offers students a comprehensive coverage of the major concepts that underlie the origins and transport of ionizing radiation in matter. Understanding atomic structure and the physical mechanisms of radiation interactions is the foundation on which much of the current practice of radiological health protection is based. The course covers the detection and measurement of radiation and the statistical interpretation of the data. The procedures that are used to protect man and the environment from the potential harmful effects of radiation are thoroughly described. Basic principles are illustrated with an abundance of worked examples that exemplify practical applications.					
5. Pre-requirements for this course (if any)**:**					
Nuclear Physics, PHY 1464					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- **Differentiate between an ionized and non-ionized radiation.**
- **Deep understand the principals of interaction radiation with matter.**
- **Full knowledge of the different units of exposure, dose absorbed dose.**
- **Understand some applications of radiation in medicine.**
- **Understanding biological effects of Radiation.**

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	**Define and recall the basic knowledge of Radiation Physic.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Recognize the interaction of ionizing radiation with matter.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Recall the different radiation detection methods.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**State the concepts of the biological Effects of Radiation.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	**Explain and summarize the basic knowledge gained from studying waves and optical 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.**	**S4, S5**	• 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.	**Radioactive Decay:** Activity, Exponential decay, Specific activity, Serial radioactive decay, Natural radioactivity, Radon and radon daughters.	**8**
2.	**Interaction of Heavy Charged Particles with Matter:** Energy-loss mechanism, Maximum energy transfer in a single collision, Single-collision energy-loss spectra, Stopping power, Semiclassical calculation of stopping power, Bethe formula for stopping power, Mean excitation energies, Stopping power of water for protons, Range, Slowing-down time.	**8**
3.	**Interaction of Electrons with Matter:** Energy-loss mechanism, Collisional stopping power, Radiative stopping power, Radiation yield, Range, Slowing-down time, Examples of electron tracks in water.	**8**
4.	**Interaction of Photons with Matter:** Interaction mechanisms, Photoelectric effect, Energy-momentum requirements for photon absorption by an electron, Compton effect, Pair production, Photonuclear reactions, Attenuation coefficients, Energy-transfer and energy-absorption coefficients, Calculation of energy absorption and energy transfer.	**80**

5.	**Neutrons, Fission and Criticality:** Neutron sources, Classification of neutrons, Interactions with matter, Elastic scattering, Neutron-proton scattering energy-loss spectrum, Reactions, Energetics of threshold reactions, Neutron activation, Fission, Criticality.	**8**
6.	**Methods of Radiation Detection:** Ionization in gases, Ionization in semiconductors, Scintillation, Photographic film, Thermo-luminescence, Other methods, Neutron detection.	**8**
7.	**Radiation Dosimetry:** Quantities and units, Measurement of exposure, Measurement of absorbed dose, Measurement of X- and gamma-ray dose, Dose measurements for charged-particle beams, Dose calculations, Other dosimetric concepts and quantities.	**8**
8.	**Biological Effects of Radiation:** Biological effects, Radiation biology, Dose-response relationship, Factors affecting dose response.	**4**
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**	**10 %**
2.	**Midterm Exam 1**	**6th week**	**25 %**
3.	**Midterm Exam 2**	**12th week**	**25 %**
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	Turner J.E., ***Atoms, Radiation, and Radiation Protection,*** Wiely-VCH Verlag GmbH & Co. KGaA (2007).
Supportive References	Attix F.H., ***Introduction to Radiological Physics and Radiation Dosimetry,*** Wiely-VCH Verlag GmbH & Co. KGaA(1986).
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- Classrooms. - Labs.
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 students complete the evaluation forms at the end of term. 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		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Quality Unit-Physics Department
REFERENCE NO.	Department council No. 06
DATE	26/09/2024