هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Radiation Dosimetry**
Course Code:	**MPHY6352**
Program:	**Medical Physics**
Department:	**Physics**
College:	**Science**
Institution:	**University of Bisha**
Version:	**1**
Last Revision Date:	**5 September 2023**

Table of Contents

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:	**6th Level / 3rd year**				
4. Course general Description					
This course describes the principal physical quantities and units in radiation dosimetry, i.e absorbed dose, imparted to an absorber, beam Fluence, exposure, air-Kerma, effective dose in an animate medium such as the human body, Relative Biologic Effectiveness (RBE), stopping power. Moreover, the concept of charged particle equilibrium (CPE), instrumentation in dosimetry and the theoretical basis of radiation dosimetry is introduced with a discussion of the basic cavity theories used in radiation dosimetry.					
5. Pre-requirements for this course (if any):					
NA					
6. Co- requirements for this course (if any):					
NA					
7. Course Main Objective(s)					
Recognize properties of radiation, the physical quantities, the measurement, calculation and assessment of ionizing radiation dose.					

1. Teaching mode (mark all that apply)

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

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	

4.	Tutorial	
5.	Others (specify)	
	Total	40

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

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Recognize the dosimetric principles quantities and units	K2	Lecturing	Quizzes Homework Midterm exam Final exam
1.2	Recognize the cavity theory and the properties of dosimeters	K2		
2.0	Skills			
2.1	Solve problems related to radiation dosimetry.	S1	Solve problems. Self-learning	Quizzes Homework Midterm exam Final exam
2.2	Illustrate the factor affecting the dose measurement.	S1	Solve problems. Self-learning	Quizzes Homework Midterm exam Final exam
2.3	Communicate positively with others.	S4	Presentation Work group	Reports Presentation
3.0	Values, autonomy, and responsibility			
3.1	Exhibit self-learning skills independently.	V2	Self-learning	Reports Presentation
3.2	Ability to work in team effectively.	V3	Work group	Reports Presentation

C. Course Content

No	List of Topics	Contact Hours
1.	**DOSIMETRIC PRINCIPLES, QUANTITIES AND UNITS** PHOTON FLUENCE AND ENERGY FLUENCE	4

	KERMA CEMA ABSORBED DOSE STOPPING POWER	
2.	**DOSIMETRIC PRINCIPLES, QUANTITIES AND UNITS** RELATIONSHIPS BETWEEN VARIOUS DOSIMETRIC QUANTITIES Energy fluence and kerma (photons) Fluence and dose (electrons) Kerma and dose (charged particle equilibrium) Collision kerma and exposure	4
3.	CAVITY THEORY Bragg–Gray cavity theory Spencer–Attix cavity theory Considerations in the application of cavity theory to ionization chamber calibration and dosimetry protocols Large cavities in photon beams Burlin cavity theory for photon beams Stopping power ratios	4
4.	RADIATION DOSIMETERS PROPERTIES OF DOSIMETERS Accuracy and precision Linearity Dose rate dependence Energy dependence Directional dependence Spatial resolution and physical size Readout convenience Convenience of use	4
5.	**Absolute Radiation Dosimetry** **<u>Calorimetric Absolute Radiation Dosimetry</u>** Basic Aspects of Absorbed Dose Calorimeter Properties of Thermistors Measurement of Thermistor Resistance Resistance versus Temperature Relationship for Thermistor Practical Aspects of Calorimetric Radiation Dosimetry Calorimetric Absolute Radiation Dosimetry	5
6.	**Absolute Radiation Dosimetry**	4

	Fricke Chemical Absolute Radiation Dosimetry Introduction to Fricke Chemical Absolute Radiation Dosimetry Radiolysis of Water Absorbed Dose in Chemical Dosimeter Measurement of Radiation-Induced Ferric Concentration Determination of Cavity Dose in Fricke Chemical Dosimetry Determination of Dose to Water from Mean Dose to Cavity	
7.	**Absolute Radiation Dosimetry** **Ionometric Absolute Radiation Dosimetry** Introduction to Cavity Ionization Chamber Ionization Chamber Dosimetry Systems Configuration of Ionization Chamber-Based Dosimetry System Collection Efficiency and Saturation Curve of Ionization Chamber Charge Loss in Ionization Chamber for Continuous Beam	5
8.	**Absolute Radiation Dosimetry** Dose to Ionization Chamber Cavity Gas Absolute Dosimetry with Ionization Chamber Standard Free-Air Ionization Chamber . Standard Bragg–Gray Cavity Ionization	5
9.	**Relative Radiation Dosimetry** Relative Ionometric Radiation Dosimetry Luminescence Dosimetry	5
10.	**Relative Radiation Dosimetry** Semiconductor Radiation Dosimetry Film Radiation Dosimetry	5
Total		45

Table: The matrix of consistency between the content and the learning outcomes of the course.

	Course Learning Outcomes

	1.1	1.2	2.1	2.2	2.3	3.1	3.2
Topic 1	√		√	√	√	√	√
Topic 2	√		√	√	√	√	√
Topic 3		√	√	√	√	√	√
Topic 4		√	√	√	√	√	√
Topic 5		√	√	√	√	√	√
Topic 6		√	√	√	√	√	√
Topic 7		√	√	√	√	√	√
Topic 8		√	√	√	√	√	√
Topic 9		√	√	√	√	√	√
Topic 10		√	√	√	√	√	√

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework, quizzes, reports, and presentation.	1: 15	10 %
2.	First term exam	7: 8	20 %
3.	Second term exam	12:13	20 %
4.	Final exam	End of Semester	50 %

*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	- Radiation Physics for Medical Physicists, Third Edition, Ervin B. Podgoršak, Faculty of Medicine, Department of Oncology and Medical Physics Unit McGill University Montreal, Springer International Publishing Switzerland 2016. -Introduction to Radiological Physics and Radiation Dosimetry, by References Frank Herbert, 2nd edition, 2004
Supportive References	RADIATION ONCOLOGY PHYSICS: A HANDBOOK FOR TEACHERS AND STUDENTS, IAEA, 2005 Printed by the IAEA in Austria July 2005.
Electronic Materials	- Blackboard. - PowerPoint presentations.

	- Digital library of University of Bisha https://ub.deepknowledge.io/Bisha
Other Learning Materials	NA

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Projector or smart board
Other equipment (depending on the nature of the specialty)	NA

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students.	Indirect (Questionnaire).
Effectiveness of students assessment	Students, Staff members, Program Leader.	Indirect (Questionnaire).
	Peer Reviewer.	Direct (Review exam)
Quality of learning resources	Students, Staff members, Program Leaders.	Indirect (Questionnaire).
The extent to which CLOs have been achieved	Students, Staff members, Program Leader.	Indirect (Questionnaire).
	Course coordinator.	Direct (Course Learning Outcomes Assessment).

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	College of Science Council
REFERENCE NO.	١
DATE	5 September 2023