#### The Hashemite University







Deanship of Academic Development and International Outreach



#### Syllabus

Radiobiology (1905081214)

Second Semester 2021/2022

COURSE INFORMATION				
Course Name:	Radiobiology	Course Code: 1905081214		
Semester:	Second	Section: Radiobiology		
Department:	Department of Medical Imaging	Core Curriculum:		
Faculty:	Applied Medical Sciences	Radiological and Medical Imaging		
Day(s) and Time	(s): Monday: 14:00-15:30	Credit Hours: 3		
Wednesday: 14:00	0-15:30	Prerequisites:		
Classroom: N	Jursing 202			
COURSE DESCRIPTION				

This course will discuss the effects of ionizing radiation at the molecular, cellular, tissue, and whole organism level understanding how cells, tissues, and the body as a whole respond to ionizing radiation is important for a comprehension of radiation protection and radiotherapy. The effects of repair, re-oxygenation, repopulation, and cell cycle redistribution will be discussed. Normal tissue toxicities including acute and late effects will be detailed in the course. Discussion will include radiation carcinogenesis, radiation Cataractogenesis, low dose effects, the linear non-threshold model for radiation damage.

#### **DELIVERY METHODS**

The course will be delivered through a combination of active learning strategies. These will include:

- PowerPoint lectures and active classroom based discussion.
- Collaborative learning through small groups acting in an interdisciplinary context.
- Relevant films and documentaries.
- Video lectures.
- E-learning resources: e-reading assignments and practice quizzes through Model and Microsoft Team.

FACULTY INFORMATION			
Name	Dr. Khalid Rabaeh		
Academic Title:	Professor		
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Sunday: 12:00-13:00 Tuesday: 12:00-13:00 Thursday: 12-13:00 Please send an e-mail (khalidr@hu.edu.jo) to meet at any othertime.

**REFERENCES AND LEARNING RESOURCES** 

Required Textbook:		
Title	Introduction to radiobiology	
Author Publisher D.R.	Maurice Tubiana, Jean Dutreix, Andre Wambersie Bewley Taylor &FrancisLtd	
Year	1990	

## STUDENT LEARNING OUTCOMES MATRIX\*

Core Curriculum Learning Outcomes	Program Learning Outcomes	Course Objectives	Course Student Learning Outcomes	Assessment Method
Think critically and creatively in a variety of methods in order to make	KP1: Develop an understanding of human anatomy and physiology as it relates to health and disease and acquire competency in medical terminology, documentation KP2: Understand the principles and physics of medical imaging technologies such as general X-ray, CT, MRI, ultrasound, fluoroscopy, nuclear medicine, dental radiography, and mammography and relate medical research KP3: Develop and implement protocols for medical imaging procedures, including patient positioning, patient care, proper exposure factor selection.	1. Explain hereditary effects of radiation	<ol> <li>Describe the effect of ionizing radiation on DNA</li> <li>Describe the effect of ionizing radiation on chromatid</li> <li>Describe the effect of ionizing radiation on chromosome</li> </ol>	<ul> <li>Exams</li> <li>Quizzes with no marks just to give chance to the students to revise the course.</li> <li>"On- line' reading assignme nts</li> </ul>

appropriate radiation protection measures, demonstrating technical competence, and the use of contrast agents SP1: Demonstrate depth of knowledge and integrate it of the basic scientific principles of all medical imaging technologies for the implementation of various protocols and techniques and to conduct scientific research in this field SP2: Use creativity, critical thinking, analysis, and research skills to modify standard procedures to adapt to new circumstances, difficult cases, or unusual situations while maintaining appropriate medical imaging quality. SP3: Evaluate and criticize all types of medical images CP1: Access, evaluate, and provide medical imaging requirements CP2: Recognizing the need to learn from professional

learning.			
managing			
learning in the			
field of medical			
imaging in an			
integrated			
manner, and			
acquiring			
continuous			
learning skills			
CP3: Demonstrate			
professional			
identity and			
responsibility			
with patients.			
colleagues.			
employers, and			
society, with			
ethical and			
professional			
behaviors and			
attitudes in the			
practice of health			
care.			
CP4: Produces			
high quality,			
diagnosable			
medical images			
by applying			
positioning skills,			
selecting technical			
parameters, and			
using radiation			
protection.			
	2. Identify the	1- Determine the cellular	. Exams
	effects of	damage by radiation	. Quizzes with
	radiation		no marks

on cells	<ul> <li>2- Explain the Bergonié and Tribondeaus law</li> <li>3- Compere between the changes of cell metabolism By radiation</li> </ul>	just to give chance to the students to revise the course. . "On-line' reading Assignments
3. Describe the Factors affecting cell radiosensitivity	What is the difference Vegetative Cells and Differentiating cells. Explain the effect of oxygen on the	. Exams . Quizzes with no marks just to give
	cell radiosensitivity Explain the effect of high LET	chance to the students to revise the

				"On-line' reading assignments
4 I eff rac hu	Describe the fect of ionizing diation on iman cells	1- 2- 3- 4-	Defined Lethal dose Explain the effect of ionizing radiation on Blood cells Explain the effect of ionizing radiation on Gastrointestinal Explain the effect of ionizing radiation on Cerebrovascular	. Exams . Quizzes with no marks just to give chance to the students to revise the course. "On-line" reading assignments

#### **ACADEMIC SUPPORT**

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Need section will exert all efforts to accommodate for individual's needs.

#### **COURSE REGULATIONS**

#### Participation

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student <u>should not miss more than 15%</u> of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor willdetermine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

#### Plagiarism

Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviors that compromise his/her own integrity as well as that of the Hashemite University.

Plagiarism includes the following examples and it applies to all student assignments or submitted work:

- Use of the work, ideas, images or words of someone else without his/her permission or reference to them.
- Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.
- Misrepresentation of the sources that were used.

#### The instructor has the right to fail the coursework or deduct marks where plagiarism is detected

Late or Missed Assignments

In all cases of assessment, students who fails to attend an exam, class project or deliver a presentation on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive afail grade for this part of the assessment.

• Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty. Assignments handed in more than 24 hours late willreceive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.

• In cases where a student misses an assessment on account of a medical reason or with prior permission; in line withUniversity regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

#### Student Complaints Policy

Students at The Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non- academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

### COURSE ASSESSMENT

#### **Course Calendar and Assessment**

Students will be graded through the following means of assessment and their final grade will be calculated from the forms of assessment as listed below with their grade weighting taken into account. The criteria for grading are listed at the end of the syllabus

Assessment	Grade Weighting	Deadline Assessment
Exam 1	20%	
Exam 2	20%	
Course assessment	20%	
Final Exam	40%	

#### **Description of Exams**

Test questions will predominately come from material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. Exam will consist of a combination of multiple choice, short answer, match, true and false and/or descriptive questions.

#### Homework:

Will be given for each chapter, while the chapter in progress you are supposed to work on them continuously and submit in next lecture when I finish the chapter.

You are also expected to work on in-chapter examples, self-tests and representative number of end of chapter problems. The answers of self-tests and end of chapter exercises are given at the end of the book.

#### Quizzes:

Unannounced quizzes will be given during or/and at the end of each chapter based upon the previous lectures. It will enforce that you come prepared to the class.

No make-up exams, homework or quizzes will be given. Only documented absences will be considered as per HU guidelines.

Grades are not negotiable and are awarded according to the following criteria\*:

Letter Grade	Description	Grade Points
A+	Excellent	4.00
А		3.75
A-		3.50
B+	Very Good	3.25
В		3.00
B-		2.75
C+	Good	2.50
С		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00
Ι	Incomplete	-

# WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION "Lecture hours and weeks are approximate and may change as needed"

Part One 1	<b>BIOLOGICAL EFFECTS OF IONIZING RADIATION</b>		
AT MOLECULES AND	) CELLS	Week 1-3	6 lectures
	1.1 Interaction of Radiation with Matter		
	1.2 Linear Energy Transfer		
	1.3 The Stage of Action of Ionizing Radiation		
	1.4 Effect of Radiation on Atom and Molecules		
	1.5 Direct and Indirect Action of Ionizing Radiatio	n	
	1.6 Effects of Oxygen on Free Radical Formation		
	1.7 Effects of Ionizing Radiation on DNA		
	1.8 Effects of Ionizing Radiation on Chromosome		
Part Two:	EFFECT OF RADIATION ON CELLS	Week 4-5	4 lectures
	2.1 Types of Cellular Damage		
	2.2 Bergonié and Tribondeaus Law		
	2.3 Radiation Induced Chromosome Damage		
	2.4 Target Theory		
	2.5 Relative Cellular Radiosensitivity		
	2.6 Survival Curves for Mammalian Cells		
Part Three	EFFECT OF IONIZING RADIATION ON		
HUMAN CELLS		Week 6-7	4 lectures
	3.1 Effect of Radiation on Blood Cells		
	3.2 Effect of Radiation on Muscle Cells		
	3.3 Effect of Radiation on Nervous Cells		
	3.4 Effect of ionizing Radiation on Reproductiv	ve Cells	
	3.5 Lethal Dose in Human		
Part Four:	EARLY AND LATE EFFECT OF RADIATION	Week 8-12	4 lectures

4.1 Early Somalic Effects		
4.2 Acute Radiation Syndrome		
4.3 Hematopoietic syndrome		
4.4 Gastrointestinal syndrome		
4.5 Cerebrovascular syndrome		
LATE EFFECT OF RADIATION	Week 13-15	6 lectures
5.1 Radiation Dose-Response		
5.2 Non-threshold		
5.3 Factors Effecting the Dose Mode	els and Theories	
5.4 Long Term Effects		
5.5 Cytogenetic damage		
5.6 Cataractogenesis		
5.7 Radiation Effects On Fetal Devel	lopment	
5.8 Radiation protection	•	
	Review and U	niversity
	<u>Week 16</u>	-
	<ul> <li>4.2 Acute Radiation Syndrome</li> <li>4.3 Hematopoietic syndrome</li> <li>4.4 Gastrointestinal syndrome</li> <li>4.5 Cerebrovascular syndrome</li> <li>LATE EFFECT OF RADIATION</li> <li>5.1 Radiation Dose-Response</li> <li>5.2 Non-threshold</li> <li>5.3 Factors Effecting the Dose Mode</li> <li>5.4 Long Term Effects</li> <li>5.5 Cytogenetic damage</li> <li>5.6 Cataractogenesis</li> <li>5.7 Radiation Effects On Fetal Deven</li> <li>5.8 Radiation protection</li> </ul>	4.2 Acute Radiation Syndrome 4.3 Hematopoietic syndrome 4.4 Gastrointestinal syndrome 4.5 Cerebrovascular syndrome <b>LATE EFFECT OF RADIATION</b> Week 13-15 5.1 Radiation Dose-Response 5.2 Non-threshold 5.3 Factors Effecting the Dose Models and Theories 5.4 Long Term Effects 5.5 Cytogenetic damage 5.6 Cataractogenesis 5.7 Radiation Effects On Fetal Development 5.8 Radiation protection Review and Un Week 16

	Classroom Participation: Assessment Criteria Quality				
Criteria	Excellent(5 points)	Good (4 points)	Satisfactory(3 points)	Needs Improvement( 2 points)	
Degree to which student integrates course readings into classroom participation	often cites from readings; uses readings to support points; - often articulates "fit" of readings with topic at hand.	-occasionally cites from readings; - sometimes uses readings to support points; -occasionally articulates "fit" of readings with topic at hand .	<ul> <li>-rarely able to cite from readings;</li> <li>-rarely uses readings to support points;</li> <li>-rarely articulates "fit" of readings with topic at hand</li> </ul>	-unable to cite from readings; -cannot use readings to support points; cannot articulates "fit" of readings with topic at hand	
Interaction/ participation inclassroom discussions	-always a willing participant, responds frequently to questions; - routinely volunteers point of view .	-often a willing participant, - responds occasionally to questions; - occasionally volunteers point of view .	-rarely a willing participant, - rarely able to respond to questions; - rarely volunteers point of view .	-never a willing participant. , -never able to respond to questions; - never volunteers point of view .	
Interaction/par ticipation in classroom learning activities	-always a willing participant; -acts appropriately during all role plays; -responds frequently to questions; -routinely volunteers point of	-often a willing participant; -acts appropriately during role plays; - responds occasionally to questions; -occasionally volunteers point of view.	-rarely a willing participant. -occasionally acts inappropriately during role plays; - rarely able to respond to direct questions; -rarely volunteers point of view .	-never a willing participant - often acts in appropriately during role plays;, - never able to respond to direct questions; - never volunteers point of view.	

	view.				
Demonstration of professional attitude and demeanor	-always demonstrates commitment through thorough preparation; - always arrives on time; - often solicits instructors' perspective outside class.	rarely unprepared; rarely arrives late; - occasionally solicits instructors' perspective outside class.	-often unprepared; occasionally arrives late; - rarely solicits instructors' perspective outside class .	-rarely prepared; - often arrives late; -never solicits instructors' perspective outside class	

#### ASSESSMENT RUBRICS

Classroom Participation: Oral Presentation										
Element	Excellent		Satisfactory		Needs Improvement		Points			
	8	7	6	5	4	3	2	1	0	
Organization	<ul> <li>There logic. of inf</li> <li>Title closin incluation approximately ap</li></ul>	e is a al sequenc formation. slide and ng slide ar ded opriately.	e	<ul> <li>Ther sequering infor</li> <li>Title closi inclui</li> </ul>	e is some l ence of mation. slide and ng slides a ded.	ogical ure	<ul> <li>Th no</li> <li>1 inf</li> <li>Tit clc no</li> </ul>	ere is little o logica sequence o formation. the slide and/ osing slides a t included.	or a of ′ or nre	
<b>Slide Design</b> (text, colors, backgroun d, illustratio ns,size, titles, subtitles)	<ul> <li>Presentation is attractive and appealing to viewers.</li> </ul>		<ul> <li>Presentation is some what appealing to viewers.</li> </ul>		<ul> <li>Little to no attempt has been made to make presentation appealing to viewers.</li> </ul>					
Content	<ul> <li>Presentation covers topic completely and in depth.</li> <li>Information is clear, appropriate, and accurate.</li> </ul>		<ul> <li>Presentation includes some essential information.</li> <li>Some information is somewhat confusing, incorrect, or flawed.</li> </ul>			<ul> <li>Preince</li> <li>litteess</li> <li>inf</li> <li>Inf</li> <li>continue</li> <li>flawed</li> </ul>	esentation cludes le sential formation. formation is nfusing, accurate, or			
Language	<ul> <li>Spelling, grammar, usage, and punctuation are accurate</li> <li>Fluent and effective</li> </ul>		<ul> <li>There are minor problems in spelling, grammar, usage, and/or punctuation.</li> </ul>		<ul> <li>There are persistent errors in spelling, grammar, usage, and/or punctuation.</li> <li>Less or not fluent and effective.</li> </ul>					

Delivery	<ul> <li>Ideas were communicatedwith enthusiasm, proper voice projection and clear delivery.</li> <li>There was sufficient eyecontact with audience.</li> <li>There were sufficient use ofother non-verbal communication skills.</li> <li>Appropriate delivery pacewas used.</li> </ul>	<ul> <li>There was some difficulty communicating ideas due to voice projection, lack of preparation, incomplete work,and/or insufficient eye contact.</li> <li>Insufficient use of non- verbalcommunication skills.</li> <li>Delivery pace is somewhat appropriate.</li> </ul>	<ul> <li>There was great difficulty communicating ideas due to poor voice projection, lack of preparation, incompletework, and/or little or no eye contact.</li> <li>No use of non verbal communication skills.</li> <li>Inappropriate deliverypace was used.</li> </ul>
Interacti onwith Audience	<ul> <li>Answers to questions are coherent and complete.</li> </ul>	<ul> <li>Most answers to questions arecoherent and complete.</li> </ul>	<ul> <li>Answers to questions areneither coherent nor complete.</li> </ul>

Answers demonstrate confidence and extensive knowledge.	<ul> <li>Answers somehow demonstrate confidence and extensive knowledge.</li> </ul>	<ul> <li>Is tentative or unclear in responses.</li> </ul>	
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