

**Course Specification**  
**RARD 520: Radiation Biology**

Institution Name: Mahidol University  
Campus/Faculty/Department: Faculty of Medicine Ramathibodi Hospital, Department of Diagnostic and Therapeutic Radiology

Section 1: General information

1. Course number and name  
Course number: RARD 520  
Course name: Radiation Biology
2. Credits: 2 (2-0-4)
3. Curriculum and type of course  
3.1 Curriculum: Radiation Biology  
3.2 Type of course: Core course
4. Instructors  
4.1 Course Coordinator: Lect. Dr.PutthipornCharoenphun  
4.2 Instructors:  

Lect. Dr.Putthiporn Charoenphun (PC)

Assoc. Prof.Dr.Vipa Boonkitticharoen (VB)
5. Semester/Year: 1<sup>st</sup> semester, 1<sup>st</sup> year student
6. Pre-requisite: RARD 528 Basic and Radiological Imaging of Anatomy and Physiology
7. Co-requisite: None
8. Classroom: To be announced
9. Revision Date: 20<sup>th</sup> November 2019 By: Committee

## Section 2: Purpose and Objective

### 1. Course Learning Outcomes

At the end of this course students are able to

1.1 Understand fundamental concepts and principles of radiation biology in the molecular aspect

1.2 Describe and discuss various biological effects of radiation and their relationships to radiation dose on different tissues and organs based on molecular and cellular biology

1.3 Describe the differences in response for normal and tumour cells from the viewpoint of clinical radiation biology

1.4 Describe genetic and epidemiological aspects of radiation exposure

1.5 Discuss the principle of population radiobiology, the derivation and use of cell survival curves

## Section 3: Course details

### 1. Course description

Review basic concepts of the cellular level, molecular aspect of radiobiology, clinical radiobiology and the health effects of radiation exposure.

2. Hours per semester:      Lecture 30 hours

## Section 4: Course Learning Outcomes

<b>Course level learning outcomes</b>	<b>Programme level learning outcomes</b>	<b>Methods</b>	<b>Assessment</b>
Understand fundamental concepts and principles of radiation biology in the molecular aspect	ELOs 2, 5	- Lecture - Presentation	- Paper Examination - Rubric presentation
Describe and discuss various biological effects of radiation and their relationships to radiation dose on different tissues and organs based on molecular and cellular biology	ELO 2	- Lecture	- Paper Examination

<b>Course level learning outcomes</b>	<b>Programme level learning outcomes</b>	<b>Methods</b>	<b>Assessment</b>
Describe the differences in response for normal and tumour cells from the viewpoint of clinical radiation biology	ELO 2	- Lecture	- Paper Examination
Describe genetic and epidemiological aspects of radiation exposure	ELO 2	- Lecture	- Paper Examination
Discuss the principle of population radiobiology, the derivation and use of cell survival curves	ELO 2	- Lecture	- Paper Examination

## Section 5: Lesson plan and assessment

### 1. Lesson plan

<b>Time (hr)</b>	<b>Topics</b>	<b>Instructors</b>	<b>Method</b>	<b>Assessment</b>
6	A. Review of basic concepts <ul style="list-style-type: none"> <li>• Gene, chromatin and chromosome</li> <li>• Cell cycle and cell division</li> <li>• Differentiation, morphogenesis</li> </ul>	PC	Lecture Presentation	Paper exam Rubric presentation
8	B. Molecular aspect of radiobiology <ul style="list-style-type: none"> <li>• Radiation action: Free radical and repair</li> <li>• DNA damage and repair</li> <li>• Chromosome aberration and cell death</li> <li>• Response from low to medium doses</li> <li>• Response from medium to high doses (normal VS cancer)</li> </ul>	VB	Lecture	Paper exam

<b>Time (hr)</b>	<b>Topics</b>	<b>Instructors</b>	<b>Method</b>	<b>Assessment</b>
12	C. Health effects <ul style="list-style-type: none"> <li>• Basic concepts</li> <li>• Fundamental basis of tissue reactions to medium – high doses</li> <li>• Lethal effect of acute whole body exposure</li> <li>• Radiation induced lung injury</li> <li>• Radiation induced cataract</li> <li>• Hereditary effects of radiation</li> <li>• Radiation carcinogenesis</li> <li>• Embryonic and fetal effects of ionizing radiation</li> </ul>	VB	Lecture	Paper exam

## 2. Measurement and Evaluation of Student Achievement

2.1	Theory (short answer questions)	85%
2.2	Presentation	5%
2.3	Behaviour/Discipline	10%

## Section 6: Assessment and improvement of the course operation

### 1. Strategies to assess the effectiveness of the courses by the students

- Assessment of instructor's teaching by student

### 2. Strategy to assess the instruction

- Assessment of students' learning records
- Assessment of instructor's teaching by student

### 3. Improvement of Instruction

- Consider the students' learning records
- Consider the students' assessment of instructor's teaching
- Consider the program committee's comment

### 4. Verification of student achievement in the subject

- By program committee and faculty-level academic committee

### 5. Review and action plan to improve the effectiveness of the course

- Using the results from 1 - 4 as inputs to the instruction improvement

## Learning Resources

1. Lodish H. Molecular Cell Biology. 6th ed. New York : WH Freeman ; 2008
2. Schoen wolf GC, Bleyl SB, Breuer PR, Francis-West PH. Larsen's Human Embryology. 4th ed. Philadelphia : Churchill Livingstone; 2009.
3. Gilkert SF. Developmental Biology. 9th ed. Massachusetts : Sinauer Associates, Inc. ; 2010
4. Joiner M, Van der Kogel A. Basic Clinical Radiobiology. 4th ed. Landon : Edward Arnold
5. Hall EJ, Giaecia AJ. Radiobiology for the Radiologist. 6th ed. Philadelphia : Lippincott Williams & Wilkins; 2006.
6. Halperin EC, Perez CA, Brady LW. Principles and Practice of Radiation Oncology. 5th ed. Philadelphia : Lippincott Williams & Wilkins; 2008.
7. Gunderson LL, Tepper JE. Clinical Radiation Oncology. 2nd ed. Philadelphia : Churchil Livingstone