

**Program SPECIFICATION FOR Ph.D. Degree in Radiobiology****Code: 1711800****University: Alexandria****Faculty: Medical Research Institute****Program Specification****A- Basic information****1- Program title: Ph.D. in Radiobiology****2- Program type:** single  double  multiple **3- Department: Radiation Sciences Department****4- Coordinator: Dr. Ebtasam Rizq Zaher****5- External evaluator: Prof. Samir Yousha El-khameesy****6- Last date of program specification approval: 8/1/2017****B- Professional Information****1- Program aims:**

1. Provide the candidate with a complete description of the latest knowledge on nuclear and radiochemistry and their applications.
2. Introduce the effects of radiation and the molecular aspects related to these effects.
3. Highlight modern Clinical Nuclear Medicine in both diagnostic and therapeutic applications.
4. Present an overview of radiation epidemiology, with a focus on radiation-related cancer.
5. Identify the impact of radioactivity on the environment including; biological impact of radiation, sources of radioactivity, routes of radiation exposure and radiotoxicity.
6. Illustrate the needs of occupationally exposed workers to have a basic understanding of the risks posed by exposure to radiation and managing these risks.
7. Summarize the advancements in theory and applications of radiation detection instruments
8. Introduce nuclear generators and nuclear reactors.
9. Encourage the acquisition of general scientific skills relating to the systematic assembly, critical analysis, interpretation and discussion of factual information and data



## 2- Intended learning outcomes ( ILOS )

### a- knowledge and understanding:

- a1- **Recall** the chemical basis of nuclear reactions.
- a2- Review radiation biology of normal and neoplastic tissue systems in terms of the cell cycle and molecular effects.
- a3- List modern clinical nuclear medicine applications including imaging, scanning and therapeutic techniques.
- a4- **Discuss** the impact of radioactivity on the environment including; sources of radioactivity, routes of radiation exposure and biological radiotoxicity.
- a5- Discuss radiation-induced carcinogenesis as documented by the emerging information from molecular radiation biology, genomic instability, bystander effects, hypersensitivity, and the adaptive response.
- a6- Define the molecular effects of radiation on signaling modalities and nucleic acids
- a7- **Recall** dosimeters and dosimetry services for measuring external exposures
- a8- Recall types of radiation detectors.
- a9- List the types of instruments involved in emergency plans and their role.
- a10- **Discuss** Design, fuel and Uses of the nuclear generator
- a11- **List** uses, types, kinetics and classifications of Reactors and nuclear fuel cycle of a reactor
- a12- **Discuss** descriptive models that explain risk of radiation
- a13- Define machines for producing X- and  $\gamma$ -rays, their basic properties and their clinical use.
- a14- Describe Radiation Treatment Parameters
- a15- **Recall** new modalities in radiotherapy and calculations for treatment.
- A16- Discuss the national and international standards and regulations of radiation protection and monitoring.

### b- Intellectual skills:

- b1- Differentiate between Radioelements, Isotopes and Radionuclides.
- b2- Classify molecular damage due to radiation and damage detection.
- b3- Distinguish the physical principles of radiotherapy.
- b4- Analyze the impact of Radon in sight of Radiation Hormesis and the LNT Model
- b5- Compare cancer induction via ionizing vs. non-ionizing radiations
- b6- Distinguish radiation damage signaling and repair.
- b7- Compare Individual monitoring for external and internal exposures in sight of biological dosimetry of exposure and dose recordings
- b8- Distinguish between different theories of radiation detectors.
- b9- Analyze data from monitoring devices and record keeping
- b10- Distinguish the mode of action and safety aspects of a generator and take decisions in various emergency situations including radiation contamination and nuclear crises.
- b11- Compare thermal and non-thermal nuclear reactors, and safety aspects in each.
- b12- Analyze the epidemiological link between radiation exposure and cancer
- b13- Compare and evaluate radiotherapy simulators and CT simulators.
- b14- Distinguish parameters affecting treatment and treatment planning with photon beam
- b15- Differentiate between conventional vs. modern modalities of radiotherapy.



### **c- Professional and practical skills:**

- c1- Practice radioimmunoassays.
- c2- Practice the Production of radiolabeled Compounds.
- c3- Demonstrate the managing of crises.
- c4- Demonstrate the construction and assessment of survival curves.
- c5- Illustrate handling of radioactive tracers.
- c6- Practice principals of safety lab work.
- c7- Interpret radiation effect on scope of Models for Cell Survival.
- c8- Illustrate the preparation of samples.
- c9- Practice basic principles of lab techniques
- c10- Demonstrate DNA extraction and Troubleshooting.
- c11- Use various types of radiation detectors.
- c12- Demonstrate survey meters calibration.
- c13- Practice a complete survey on lab and personnel using radiation detectors.

### **d- General and transferable skills:**

- d1- Communicate effectively using scientific language and reasoning
  - d2- perform self and peer appraisal.
  - d3- Maintain an open and questioning mind toward ideas and alternative points of view.
  - d4- Ability to evaluate and solve problems based on scientific evidence
  - d5- Increase written and oral skills
  - d6- Utilize communicating skills
  - d7- Master the access to web sites to perform a research or solve problems.
  - d8- Develop the skill of communication and sharing ideas with professors and colleagues.
  - d9- Develop team work skills
  - d10- Use information technology.
  - D11- Manage scientific meetings and appropriately utilize time
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## **3- Academic standards**

### **3a External references for standards (Benchmarks)**

Generic Academic Reference Standards of the National Authority for Quality Assurance and Accreditation of Education (NAQAAE).

**Date of Academic Reference standards (ARS) approval by Institute Council:  
12/2/2014**

### **3b Comparison of provision to selected external references**



<b>NAQAAE</b>	<b>ARS for PhD in radiobiology</b>
<b>A1-Basic facts , theories, of the specialty and related subjects/ fields</b>	A1- Review the molecular basis of radiation biology of normal and neoplastic tissue systems. A2- Recognize the chemical basis of nuclear reactions.
<b>A2-Mutual relation between professional practice and effects on environment</b>	A3- Identify the impact of radioactivity on the environment including; sources of radioactivity, routes of radiation exposure and biological radiotoxicity.
<b>A3-Recent advances in the field of practice</b>	A4- Review modern clinical nuclear medicine applications including imaging, scanning and therapeutic techniques. A5-Review recent scientific research in the field of radiobiology.
<b>A4-Details of ethical &amp; legal practice</b>	A6- Identify legal and ethical considerations in radiobiology practice and research according to national and international guidelines.
<b>A5 -Quality standards of the practice</b>	A7- Recognize quality standards in handling radioactive materials and production of radiolabelled compounds.
<b>A6- Design, conduction &amp; publishing of scientific research</b>	A5-Review recent scientific research in the field of radiobiology.
<b>A7- Ethical considerations in different types of scientific research</b>	A6- Identify legal and ethical considerations in radiobiology practice and research according to national and international guidelines.
<b>B1- Analyze, deduce, extrapolate &amp; evaluation of information</b>	B1- Understand the link between radiation exposure and cancer B2- Examine descriptive models that explain risk of radiation.
<b>B2- Solve the majority of problems in the specialty according to the available data ( complete or incomplete)</b>	B3- Interpret data from monitoring devices in order to assess radiation protection programs in facilities. B4- Examine Individual monitoring for external and internal exposures in sight of biological dosimetry of exposure and dose recordings. B5- Analyze parameters affecting treatment and treatment planning with photon beam
<b>B3- Conduct research studies that add to the existing specialty knowledge</b>	B6- Design, conduct and publish scientific research that adds to the existing knowledge in radiobiology.
<b>B4- Publish scientific articles/papers ( in indexed journals)</b>	B7- Publish scientific articles/papers
<b>B5- Plan and implement ( or supervise implementation of) enhancement &amp; Improvement approaches to practice</b>	B8- Plan for periodic self-enhancement of his/her skills.
<b>B6- Take decisions in various professional situations ( including dilemmas &amp;</b>	B9- Take decisions in various emergency situations including radiation contamination and nuclear crises.



<b>controversial issues)</b>	
<b>B7- Add to the specialty field through creativity &amp; innovation</b>	B10- Add to the specialty field through creativity & innovation
<b>B8- Manage discussions on basis of evidence and proofs</b>	B11- Manage discussions on basis of evidence and proofs
<b>C1- Competent in all basic and all required advanced professional skills ( to be determined according to the specialty board/ department)</b>	C1- completely perform radioanalytical procedures taking into consideration radiation lab safety measures.
<b>C2- Write and appraise reports</b>	C2- independently perform radiation surveying for labs and personnel, interpret the obtained readings and construct a plan suitable for any deviation from normal values.
<b>C3-Evaluate <i>and improve</i> methods and tools used in specialty</b>	C3- Evaluate the available tools for radiation detection and plan to improve methods for detection.
<b>C4-Use technology to advance practice</b>	C4- Use technology to enforce his knowledge in the field of radiation, analyze data and improve his practice
<b>C5- Plan professional development courses to improve practice and enhance performance of juniors</b>	C5- Plan for enhancing professional practice and improving performance of other radiobiologists
<b>D1- Communicate effectively using all methods</b>	D1- Communicate effectively using different methods.
<b>D2- Use information technology to improve his/her professional practice</b>	D2- Use information technology to obtain data and improve his/her professional practice.
<b>D3- Teach and evaluate others</b>	D3- Perform self and peer appraisal.
<b>D4- Perform self appraisal&amp; seek continuous learning</b>	D3- Perform self and peer appraisal. D4- To be motivated and able to seek continuous learning and help in teaching others.
<b>D5- Use different sources of information to obtain data</b>	D5- Use different sources of information to obtain data
<b>D6- Work in teams as well as a member in larger teams</b>	D6- Work in a team and understands the responsibilities of a team leader
<b>D7- Manage scientific meetings and appropriately utilize time</b>	D7- Manage scientific meetings and appropriately utilize time

#### 4- curriculum structure and contents



**4.a program duration:3.5 -6 years**

**4.b programstructure :**

**4.b.i- No. of hours per week in each year/semester:**

Semester	Core Courses	Elective Courses
	No. of hours	No. of hours
First semester	6 CH	3 CH
Second semester	6 CH	3 CH
Third semester	6 CH	

**+24 hrs for thesis**

**4.b.ii- No. of credit hours** Lectures  Practical  Total

Compulsory  Elective  Optional

**4.b.iii- No. of credit hours of basic science courses** No.  %

**4.b.iv- No. of credit hours of courses of social sciences and humanities.** No.  %

**4.b.v- No. of credit hours of specialized courses** No.  %

**4.b.vi- No. of credit hours of other courses** No.  %

**4.b.vii- Field Training** No.  %

**4.b.viii- Program levels (in credit-hours system)**

Student is required to pass at least 12 credit hours with CGPA not less than C+ before submitting a thesis proposal.

## 5- Program Courses

### 5.1- Compulsory(18 CH)



Code No.	Course Title	No. of credit hours	No. of hours /week	
			Lecture	Practical
1711801	Radiation chemistry	3	2	2
1711802	Radiobiology	3	2	2
1711803	Applications of radiation in Medicine	2	2	-
1711804	Environmental Radiation Sciences	2	2	-
1711805	Radiation and cancer	1	1	-
1711806	Experimental Radiobiology	2	1	2
1711807	Assessment of occupational radiation doses	1	1	-
1711808	Radiation Survey Instrumentation	2	1	2
1711809	Contamination Monitoring Instrumentation	2	2	-

### 5.2- Elective I (3 CH)

Code No.	Course Title	No. of credit hours	No. of hours /week	
			Lecture	Practical
1711810	Generators and radiation power plants	2	2	-
1711811	Nuclear reactors	2	2	-
1711812	Epidemiology of radiations	1	1	-
1711813	Treatment machines for external beam radiotherapy	2	2	-
1711814	External Photon Beam: Physical aspects.	2	2	-
1711815	Clinical treatment planning in external photon beam radiotherapy	2	2	-

### 5.3- Elective II (3 CH)

Code No.	Course Title	No. of credit hours	No. of hours /week	
			Lecture	Practical
1701820	Biochemistry	3	2	2
1722820	Molecular biology	3	2	2
1721820	Medical statistics	3	2	2
1704820	Pharmacology	3	2	2
1721821	Computer	3	2	2

### 5.4- Optional – (none)

## 6- Program admission requirements

Postgraduate students with a M.Sc. in Radiobiology or an equivalent degree.

**7- Regulations for progression and program completion**

For the progression and completion of the program to obtain the degree of Ph.D. in Radiobiology, the student must:

1. Complete 24 credit hours with CGPA of at least C+; and
2. Submit a thesis validity report by an examination committee approved by the department council and their members include at least one external examiner.

**8- Evaluation of Students enrolled in the program.**

<b>Tool evaluation</b>	<b>Intended learning outcomes being assessed</b>
Written	ILOs a&b
Practical	ILOs c
Oral	ILOs a ,b &d
Semester Work	ILOs b& d

**Evaluation of the Program**

<b>Evaluator</b>	<b>Tool</b>	<b>Sample</b>
1- Senior students	Interview	At least 50 %
2- Alumni	Interview	Representative sample
3- Stakeholders (Employers)	Questionnaire	Representative sample
4- External Evaluator(S) or External Examiner (s)	Reports	Prof. Samir Yousha El- khameesy

**Dates of Previous editions/revisions:**

<b>Editions/Revisions Number</b>	<b>Date</b>
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Edition no.1	2009
Edition no. 2	2011
Edition no.3	5/6/2014
Edition no.3, revision no.1	12/2014
Edition no.3, revision no.2	10/2016
Edition no.3, revision no.3	9/2017

**Program coordinator:**

Name: Ass. Prof. Ebtsam R. Zaher    Signature .....

**Department Head:**

Name: Prof. Mohamed Morsi    Signature: .....

**Date of Department Council Approval: 6/9/2017**









Courses	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	C13	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	D11
1711801 Radiation chemistry	x	x												x	x	x			x					
1711802 Radiobiology			x	x	x	x								x	x	x			x					
1711803 Applications of radiation in Medicine														x	x	x		x	x			x	x	
1711804 Environmental Radiation Sciences														x			x		x	x		x		
1711805 Radiation and cancer														x	x	x			x					
1711806 Experimental Radiobiology							x	x	x	x				x	x	x			x		x			
1711807 Assessment of occupational radiation doses																x				x		x	x	
1711808 Radiation Survey Instrumentation											x	x	x	x				x	x				x	
1711809 Contamination Monitoring Instrumentation														x	x					x				x
1711810 Generators and radiation power plants														x			x			x				
17118011 Nuclear reactors																x			x	x				x
1711812 Epidemiology of radiations														x			x				x			
1711813 Treatment machines for external beam radiotherapy														x	x	x								
1711814 External Photon Beam: Physical aspects.														x	x					x				
1711815 Clinical treatment planning in external photon beam radiotherapy															x	x						x	x	





Program ARS	b1	b2	b3	b4	b5	b6	b7	b8	b9	b 10	b11	b 12	b 13	b 14	b 15	Thesis
B1- Understand the link between radiation exposure and cancer		x			x											
B2- Examine descriptive models that explain risk of radiation.		x		x								x				
B3- Interpret data from monitoring devices in order to assess radiation protection programs in facilities.							x	x	x							
B4- Examine Individual monitoring for external and internal exposures in sight of biological dosimetry of exposure and dose recordings.							x		x							
B5- Analyze parameters affecting treatment and treatment planning with photon beam														x	x	
B6- Design, conduct and publish scientific research that adds to the existing knowledge in radiobiology. thesis																x
B7- Publish scientific articles/papers thesis																x
B8- Plan for periodic self-enhancement of his/her skills.																x
B9- Take decisions in various emergency situations including radiation contamination and nuclear crises.										x						
B10- Add to the specialty field through creativity & innovation																x
B11- Manage discussions on basis of evidence and proofs											x					







- Ph.D. of Radiobiology Teaching and Learning Methods Vs Courses Matrix***

	1811801	1811802	1811803	1811804	1811805	1811806	1811807	1811808	1811809	1811810	1811811	1811812	1811813	1811814	1811815
Lecture	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Practical	x	x				x		x							
Brainstorming	x	x	x	x		x	x	x	x	x		x		x	
Discussion Groups	x	x	x		x	x	x	x		x	x	x	x		x
Problem Solving	x		x									x			
Case Study			x									x			
Field Training															
Role playing			x												
Training Workshops															
Self-Directed Learning		x	x	x		x	x	x	x			x		x	
e-learning															
Project	x						x			x			x		x