Course Title:	Advanced Nuclear Medicine
Course Code:	
Program:	Master of Science in Medical Physics
Department:	Physics
College:	Sciences
Institution:	Umm Al-Qura University
Version:	2nd
Last Revision Date:	January 2025

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☒ Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (2nd year /3rd semester)				
4. Course General Description:				
This course provides a comprehensive introduction to the fundamental principles of nuclear medicine physics. It covers the interaction of radiation with matter, radioactive decay processes, and the operation of radiation detection instruments. The course explores key imaging modalities in nuclear medicine, including gamma cameras, SPECT, PET, and hybrid imaging systems, focusing on their structure, performance, and quality control. Additionally, it addresses the essential principles of radiobiology and radiation protection to ensure safe and effective application in clinical and research settings.				
5. Pre-requirements for this course (if any)**:**				
6. Pre-requirements for this course (if any)**:**				
7. Course Main Objective(s):				
On completing the course, students will be able to: 1. Explain the principles of nuclear physics and radiation interactions with matter. 2. Understand the operation and applications of radiation detector instruments. 3. Describe the physical principles behind nuclear medicine imaging modalities. 4. Perform quality control procedures and apply radiation protection measures.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100

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

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
3.	**Lectures**	45
4.	**Laboratory/Studio**	
5.	**Field**	
6.	**Tutorial**	
7.	**Others (specify)……**	
	Total	45

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	Understand radioactive decay, radionuclide production, and their applications.	**K1-I**	Demonstrating the basic principles through lectures.	a) Quizzes (Elearning) b) Short exams (midterm exams)
1.2	Gain knowledge of radiation detectors and modern imaging techniques like SPECT and PET.	**K2-P**	Demonstrating the basic principle of the experiment.	Homework. Writing scientific Reports.
1.3	Learn about hybrid imaging technologies	**K3-M**		

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	and their clinical integration.		Show the best ways to perform the experiments.	
2.0	**Skills**			
2.1	Analyze nuclear medicine data using statistical methods.	**S1-P**	Preparing main outlines for teaching	Midterm exam. Exams, short quizzes
2.2	Operate and troubleshoot nuclear medicine equipment effectively.	**S2-M**		
2.3	Optimize imaging protocols to improve diagnostic accuracy and patient safety.	**S3-M**		
3.0	**Values, autonomy, and responsibility**			
3.1	Ensure compliance with radiation safety and regulatory standards.	**V1-P**	preparing a report on some topics related to the course	Evaluation of presentations
3.2	Practice ethical decision-making in the use of nuclear technologies.	**V2-P**		

C. Course Content:

No	List of Topics	Contact Hours
8.	RADIOACTIVE DECAY: 1. Exponential Decay, Specific Activity, Decay Of A Mixed Radionuclide Sample 2. Parent-Daughter Decay	**3**
9.	RADIONUCLIDE AND RADIOPHARMACEUTICAL PRODUCTION A. Reactor-produced radionuclides B. Accelerator-produced radionuclides	**3**

	C. Radionuclide generators D. Equations for radionuclide production E. Radionuclides for nuclear medicine F. Radiopharmaceuticals for clinical applications	
10.	RADIATION DETECTORS AND RADIATION COUNTING SYSTEMS: 1. Gas-filled detectors 2. Scintillation detectors 3. NaI(Tl) well counter 4. Counting with conventional NaI(Tl) detectors 5. Liquid scintillation counters 6. In vivo counting systems	**3**
11.	ELECTRONIC INSTRUMENTATION FOR RADIATION DETECTION A. Preamplifiers B. Amplifiers C. Pulse-Height Analyzers D. Time-To-Amplitude Converters E. Digital Counters And Rate Meters F. Coincidence Units G. High-Voltage Power Supplies H. Nuclear Instrument Modules I. Oscilloscopes	**3**
12.	NUCLEAR COUNTING STATISTICS A. Types of measurement error B. Nuclear counting statistics C. Propagation of errors D. Applications for statistical analysis E. Statistical tests	**3**
13.	COUNTING SYSTEMS A. NaI(Tl) well counter B. Counting with conventional NaI(Tl) detectors	**3**

	C. Liquid scintillation counters D. Gas-filled detectors E. Semiconductor detector systems F. In vivo counting systems	
14.	THE GAMMA CAMERA: BASIC PRINCIPLES: 1. System Components 2. Detector System and Electronics 3. Collimators 4. Event Detection in a Gamma Camera 5. types of Gamma Cameras and their Clinical Uses	3
15.	THE GAMMA CAMERA: PERFORMANCE CHARACTERISTICS: A. Basic performance characteristics B. Detector limitations: nonuniformity and nonlinearity measurements of gamma camera performance C. Design and performance characteristics of parallel-hole collimators D. Performance characteristics of converging, diverging, And pinhole collimators E. Measurements of gamma camera performance	6
16.	IMAGE QUALITY IN NUCLEAR MEDICINE: 1. basic methods for characterizing and evaluating image quality 2. spatial resolution 3. contrast	3
17.	SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY: 1. SPECT systems 2. practical implementation of SPECT 3. performance characteristics of SPECT systems applications of SPECT	3
18.	POSITRON EMISSION TOMOGRAPHY: 1. basic principles of PET imaging 2. PET detector and scanner designs 3. data acquisition for PET 4. data corrections and quantitative aspects of PET	3

	5. performance characteristics of PET systems clinical and research applications of PET	
19.	Hybrid Imaging: SPECT/CT and PET/CT A. Motivation for hybrid systems B. X-ray computed tomography C. SPECT/CT systems D. PET/CT E. Attenuation and scatter correction using CT F. Hybrid PET/MRI and SPECT/MRI	**3**
20.	RADIATION SAFETY IN NUCLEAR MEDICINE: 1. quantities and units 2. regulations about the use of radionuclides 3. safe handling of radioactive materials and disposal of radioactive waste	**6**

Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments, Quizzes and Homework	Weekly	10%
2.	Mid Term Exam (practical)	8th	20%
3.	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	11th	20%
...	Final Exam (Written Test)	18th	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	**Physics in Nuclear Medicine** 5. *Authors*: Simon R. Cherry, James A. Sorenson, and Michael E. Phelps 6. *Edition*: 4th Edition (2012) 7. *Publisher*: Elsevier/Saunders 8. *ISBN*: 978-1416051985

	9. *Description*: This comprehensive text provides current guidance on the physics underlying modern nuclear medicine and imaging using radioactively labeled tracers. The fourth edition features a full-color layout and the latest information on instrumentation and technology.
Supportive References	- List Essential References Materials (Journals, Reports, etc.) -Rachel A. Powsner, Edward R. Powsner "Essential Nuclear Medicine Physics" Blackwell Publishing Ltd 2006. -Peter F. Sharp, Howard G. Gemmell and Alison D. Murray "Practical Nuclear Medicine 3rd add." Springer–Verlag London Limited 2005. -Basics of PET Imaging, Second Edition, Gopal B. Saha Springer Science& Business Media, LLC 2010, ISBN; 978-1-4419-0804-9. -Radiation Safety in Nuclear Medicine, Second Edition, Max H. Lombardi, 2007 by Taylor & Francis Group, ISBN: 0-8493-8168-1
Electronic Materials	3. - Journal of nuclear medicine technology; http://tech.snmjournals.org/ -Journal of nuclear medicine; http://jnm.snmjournals.org/ -Journal of medical physics; http://www.jmp.org.in/md.asp
Other Learning Materials	4. Other learning materials such as computer-based programs/CD, professional standards or regulations, and software

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	1. Classrooms: Equipped with whiteboards, projectors, and seating for interactive theoretical discussions. 2. Seminar Rooms: Spaces for collaborative discussions, presentations, and guest lectures. 3. Simulation Rooms: For visualizing quantum phenomena using computational tools.
Technology equipment (Projector, smart board, software)	10. Projector and Smart Board: For presenting derivations, diagrams, and visual simulations of quantum field interactions.

Items	Resources
Other equipment (Depending on the nature of the specialty)	11. Access to Online Resources: Journals, databases, and virtual lecture platforms for advanced research.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Academic Program Coordinator	Conduct mid-term and end-of-term surveys to gather students' perceptions of teaching methods, clarity of explanations, and engagement.
Effectiveness of students' assessment	Course Instructor	Compare assessments (quizzes, assignments, projects) with course learning outcomes (CLOs) to ensure alignment.
Quality of learning resources	Course Instructor	Track student engagement with electronic materials (e.g., downloads, page visits) and physical resources.
The extent to which CLOs have been achieved	External Academic Reviewer	Collect feedback from graduates on the applicability of course content and learning outcomes in research or professional practice.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	

Course Title:	**Advanced Radiotherapy physics**
Course Code:	
Program:	**Master of Science in Medical Physics**
Department:	**Physics**
College:	**Sciences**
Institution:	**Umm Al-Qura University**
Version:	2nd
Last Revision Date:	**January 2025**

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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
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (3rd semester /2nd year)				
4. Course General Description:				
This course covers the analysis of radiation doses and the physical and medical quantities used in hospitals and radiation therapy centers. It explains the production of high-energy photon beams, the components of linear accelerators, and the methods for calculating monitor units and applying correction factors. Additionally, the course emphasizes the principles of basic radiotherapy planning, including the factors influencing radiation dose distribution.				
5. Pre-requirements for this course (if any)**:**				
6. Pre-requirements for this course (if any)**:**				
7. Course Main Objective(s):				
12. Develop expertise in the principles of radiation therapy physics, including the interaction of high-energy beams with matter and their medical applications. 13. Explain the production and use of high-energy photon beams, the components of linear accelerators, and the calculation of monitor units with correction factors. 14. Introduce the fundamentals of radiotherapy planning and explore the factors affecting radiation dose distribution for effective treatment delivery.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid 21. Traditional classroom 22. E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
23.	**Lectures**	45
24.	**Laboratory/Studio**	
25.	**Field**	
26.	**Tutorial**	
27.	**Others (specify)……**	
	Total	45

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	Explain the use of commissioning data in radiotherapy.	**K1-I**	Lecture	Homework and discussion
1.2	Describe the production of useful photon beams.	**K2-P**	Lecture	Homework and discussion
1.3	Identify photon and electron beam characteristics.	**K1-P**	Lecture	Homework and discussion
2.0	**Skills**			
2.1	Justify therapeutic planning for various fields and energies.	**S1-P**	Lecture	Homework and discussion

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.2	Perform monitor unit calculations.	**S2-P**	Lecture	Homework and discussion
2.3	Apply correction factors for dose calculation.	**S3-M**	Lecture	Homework and discussion
3.0	**Values, autonomy, and responsibility**			
3.1	Show responsibility for self-learning in radiotherapy.	**V1-P**	Lecture	Homework and discussion
3.2	Manage and organize data for planning.	**V2-M**	Lecture	Homework and discussion
...				

C. Course Content:

No	List of Topics	Contact Hours
28.	Production of a clinically useful beam, specification of beam quality	3
29.	Photon beam characteristics	3
30.	Kilovoltage x-rays in radiotherapy	3
31.	Electron beam characteristics	3
32.	Treatment planning	3
33.	Planning techniques	3
34.	Quality control of Linac and dose	3
35.	Three-Dimensional Conformal Radiation Therapy	3
36.	Intensity-Modulated Radiation Therapy	3
37.	Stereotactic Radiotherapy and Radiosurgery	3
38.	Stereotactic Body Radiation Therapy	3
39.	High-Dose-Rate Brachytherapy Prostate Implants: Technique, Dosimetry, and Treatment Planning Intravascular Brachytherapy	6
40.	Image-Guided Radiation Therapy Proton Beam Therapy	3
14.	Knowledge-Based Treatment Planning	3
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	Midterm	8th week	30%
5.	Research assignment	12th week	20%
6.	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	**Khan's The Physics of Radiation Therapy** 15. *Authors*: Faiz M. Khan, John P. Gibbons 16. *Edition*: 5th Edition (2014) 17. *Publisher*: Lippincott Williams & Wilkins 18. *ISBN*: 978-1451182453 19. *Description*: This comprehensive text provides an in-depth understanding of the physics and practical clinical applications of advanced radiation therapy technologies. It covers topics such as 3D conformal radiotherapy, stereotactic radiosurgery, intensity-modulated radiation therapy, and proton beam therapy
Supportive References	• **Radiation Oncology Physics: A Handbook for Teachers and Students** 20. *Editor*: E.B. Podgorsak 21. *Edition*: 1st Edition (2005) 22. *Publisher*: International Atomic Energy Agency (IAEA) 23. *ISBN*: 978-9201073044 24. *Description*: This handbook is aimed at students and teachers involved in teaching programs in the field of medical radiation physics. It covers the basic medical physics knowledge required for modern radiation oncology. IAEA Publications • **Handbook of Radiotherapy Physics: Theory and Practice**

	25. *Editors*: P. Mayles, A. Nahum, J.C. Rosenwald 26. *Edition*: 1st Edition (2007) 27. *Publisher*: CRC Press 28. *ISBN*: 978-0750308605 29. *Description*: This handbook provides a comprehensive guide to the theory and practice of radiotherapy physics. It covers all aspects of radiotherapy physics, including basic physics, dosimetry, treatment planning, and quality assurance.
Electronic Materials	1. Physics in Medicine and Biology 2. British Journal of Radiology 3. Medical Physics 4. Journal of Applied Clinical Medical Physics 5. The Journal of Radiotherapy in Practice
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	7. Classrooms: Equipped with whiteboards, projectors, and seating for interactive theoretical discussions. 8. Seminar Rooms: Spaces for collaborative discussions, presentations, and guest lectures. 9. Simulation Rooms: For visualizing quantum phenomena using computational tools.
Technology equipment (Projector, smart board, software)	30. Projector and Smart Board: For presenting derivations, diagrams, and visual simulations of quantum field interactions.
Other equipment (Depending on the nature of the specialty)	31. Access to Online Resources: Journals, databases, and virtual lecture platforms for advanced research.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Academic Program Coordinator	Conduct mid-term and end-of-term surveys to

Assessment Areas/Issues	Assessor	Assessment Methods
		gather students' perceptions of teaching methods, clarity of explanations, and engagement.
Effectiveness of students' assessment	Course Instructor	Compare assessments (quizzes, assignments, projects) with course learning outcomes (CLOs) to ensure alignment.
Quality of learning resources	Course Instructor	Track student engagement with electronic materials (e.g., downloads, page visits) and physical resources.
The extent to which CLOs have been achieved	External Academic Reviewer	Collect feedback from graduates on the applicability of course content and learning outcomes in research or professional practice.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

Course Title:	**Advanced Medical Radiation Physics**
Course Code:	
Program:	**Master of Science in Medical Physics**
Department:	**Physics**
College:	**Sciences**
Institution:	**Umm Al-Qura University**
Version:	**2nd**
Last Revision Date:	**January 2025**

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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
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (3rd semester /2nd year)				
4. Course General Description:				
This course focuses on the study of natural background radiation and medical radiation sources. It covers conventional X-ray dosimetry, computed tomography (CT) dosimetry, mammography dosimetry, and nuclear medicine dosimetry. Additionally, the course explores the concepts and measurement techniques of ambient dose equivalent, directional dose equivalent, and personal dose equivalent. It also addresses the management of radioactive contamination, calculation of decontamination factors, and assessment of skin dose resulting from decontamination procedures.				
5. Pre-requirements for this course (if any)**:**				
6. Pre-requirements for this course (if any)**:**				
7. Course Main Objective(s):				
32. Introduce the basic concepts of atomic and nuclear physics, including atomic and nuclear structures, nuclear forces, and electromagnetic radiation. 33. Explain radiological units, nuclear transformation processes (radioactivity, decay properties, and equilibrium), and the medical applications of isotopes. 34. Describe the interaction of ionizing radiation with matter, covering processes such as photoelectric effect, Compton scattering, and pair production, with an emphasis on their clinical relevance and associated calculations.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid 41. Traditional classroom 42.E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
43.	**Lectures**	45
44.	**Laboratory/Studio**	
45.	**Field**	
46.	**Tutorial**	
47.	**Others (specify)……**	
	Total	45

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	Outlines about natural background radiation and other sources.	**K1-I**	Start each chapter by the general idea of the meaning of Medical radiation physics the course	1. Homework Interactive 2. discussion 3. Short exam1

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
			information and principles through lectures. Describing radiation interactions concepts with solving problems Describing the procedure of Calculation the Rang and scuttering radiations using Radiation physics equations.	4. Short exam2 Final exam
1.2	List the RDLs for Medical Exposure	**K2-P**		1. Presentations 2. Quizzes 3.. Problem solving
1.3	Describe calibration of thermoluminescent dosimeters	**K3-M**		1. Oral questions 2. Presentations 3 . Quizzes 4. Problem solving
2.0	**Skills**			
2.1	Evaluating the internal effective dosses for organs in Medical exposure and related fields of studies.	**S1-P**	Lectures	Exam must contain questions that can measure these skills.
2.2	Applying the mathematical expressions in calculating the external and internal doses due to external and internal exposure.	**S2-M**	Brain storming	Quiz and exams Discussions after the lecture
2.3	Integrate information technology (IT) based solution into radiation.	**S3-M**	Discussion	Quiz and exams Discussions after the lecture
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate ethical responsibility in managing radiation	V3-P	Discuss ethical scenarios, include case studies of radiation use.	Discussions, case study evaluation

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	exposure and medical applications.			
3.2	Engage in lifelong learning and critical reflection to stay updated on medical radiation practices.	V1-M	Encourage independent research.	Presentations, reflective essays

C. Course Content:

No	List of Topics	Contact Hours
48.	**Introduction to Modern Physics** Classification of Radiation Classification of Ionizing Radiation Classification of Directly & Indirectly Ionizing Radiation Physical Quantities and Units Coulomb Scattering	3
49.	**Production of X-Rays and Rutherford–Bohr Model of the Atom** Synchrotron Radiation. Čerenkov Radiation Two-Particle Collisions	3
50.	**Interactions of radiation with Matter** General Aspects of Energy Transfer from Charged Particle to Medium. General Aspects of Stopping Power Collision (Electronic) Stopping Power for Heavy Charged Particles Interactions of Photons with Matter General Aspects of Photon Interactions with Absorbers Thomson, Rayleigh Scattering. Photoelectric Effect & Pair Production	6
51.	**Energy Transfer and Absorption in Photon Interactions with Matter** Macroscopic Attenuation Coefficient Energy Transfer from Photons to Charged Particles in Absorber Energy Absorption	3

	Coefficients of Compounds and Mixtures Effects Following Photon Interactions with Absorber	
52.	**Interactions of Neutrons with Matter** General Aspects of Neutron Interactions with Absorbers. Neutron Interactions with Nuclei of the Absorber Neutron Kerma Neutron Beams in Medicine Neutron Radiography	3
53.	**Kinetics of Radioactive Decay** General Aspects of Radioactivity General Form of Daughter Activity Equilibria in Parent–Daughter Activities Bateman Equations for Radioactive Decay Chain Modes of Radioactive Decay	6
54.	**Production of Radionuclides** Origin of Radioactive Elements Nuclear Activation with Neutrons Production of Radionuclides with Radionuclide Generator Nuclear Activation with Protons and Heavier Charged Particles	3
55.	**Waveguide Theory** Microwave Propagation in Uniform Waveguide General Conditions for Particle Acceleration Particle Accelerators in Medicine Basic Characteristics of Particle Accelerators Circular Accelerators	3
56.	**Fundamentals of Radiation Dosimetry** Ionizing Radiation Beams Kerma Versus Absorbed Dose Radiation Dosimetry Systems. Cavity Theories for Radiation Dosimetry. Absolute Radiation Dosimetry	6
57.	**Relative Radiation Dosimetry**	6

	Relative Ionometric Radiation Dosimetry. Luminescence Dosimetry. Semiconductor Radiation Dosimetry Film Radiation Dosimetry	
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
10.	Exercises & Homeworks	All weeks	20 %
11.	Midterm's exam	8th week	30 %
12.	Final Exam (theoretical)	18th week	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	1-Radiation Physics for Medical Physicists 3rd ed Ervin B. Podgoršak Springer 2016 ISBN 978-3-319-25380-0 2-Introduction to radiological physics and radiation dosimetry Frank Herbert- Wiley 2004, ISBN-13: 978-0-471-01 146-0
Supportive References	3- Compendium to Radiation Physics for Medical Physicists: 300 Problems and Solutions Ervin B. Podgoršak Springer 2014 ISBN 978-3-319-25380-0
Electronic Materials	www.iomp.org www.aapm.org www.afomp.org
Other Learning Materials	The following journals are recognized as official publications of the IOMP: 1. Physics in Medicine and Biology 2. Physiological Measurement 3. Medical Physics 4. Journal of Applied Clinical Medical Physics 5. Medical Physics International

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	13. Classrooms: Equipped with whiteboards, projectors, and seating for interactive theoretical discussions. 14. Seminar Rooms: Spaces for collaborative discussions, presentations, and guest lectures. 15. Simulation Rooms: For visualizing quantum phenomena using computational tools.
Technology equipment (Projector, smart board, software)	35. Projector and Smart Board: For presenting derivations, diagrams, and visual simulations of quantum field interactions.
Other equipment (Depending on the nature of the specialty)	36. Access to Online Resources: Journals, databases, and virtual lecture platforms for advanced research.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Academic Program Coordinator	Conduct mid-term and end-of-term surveys to gather students' perceptions of teaching methods, clarity of explanations, and engagement.
Effectiveness of students' assessment	Course Instructor	Compare assessments (quizzes, assignments, projects) with course learning outcomes (CLOs) to ensure alignment.
Quality of learning resources	Course Instructor	Track student engagement with electronic materials (e.g., downloads, page visits) and physical resources.
The extent to which CLOs have been achieved	External Academic Reviewer	Collect feedback from graduates on the applicability of course

Assessment Areas/Issues	Assessor	Assessment Methods
		content and learning outcomes in research or professional practice.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

Course Title:	**Advanced Medical Imaging**
Course Code:	
Program:	**Master of Science in Medical Physics**
Department:	**Physics**
College:	**Sciences**
Institution:	**Umm Al-Qura University**
Version:	2nd
Last Revision Date:	**January 2025**

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3 hourse)				
2. Course type				
A.	☐University	☐College	☐Department	☒ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (3rd semester /Second year)				
4. Course General Description:				
This course focuses on the study of natural background radiation and medical radiation sources, including conventional X-ray dosimetry, computed tomography dosimetry, mammography dosimetry, and nuclear medicine dosimetry. It also covers the concepts and measurement of ambient dose equivalent, directional dose equivalent, and personal dose equivalent. Additionally, the course addresses the management of radioactive contamination, decontamination factors, and the assessment of skin dose resulting from decontamination procedures.				
5. Pre-requirements for this course (if any)**:**				
6. Pre-requirements for this course (if any)**:**				
7. Course Main Objective(s):				
37. Understand the dynamic regulation and interactions of cells and proteins within living cells and their role in cellular biology and pathophysiology. 38. Explore advances in molecular imaging technologies and their applications in chemistry, molecular biology, therapeutics, engineering, and biomedical sciences. 39. Develop knowledge of molecular imaging concepts and techniques, enabling their application in clinical and research settings.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid 58. Traditional classroom 59. E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
60.	**Lectures**	45
61.	**Laboratory/Studio**	
62.	**Field**	
63.	**Tutorial**	
64.	**Others (specify)……**	
	Total	45

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	Understand principles and applications of X-ray, CT, MRI, and ultrasound technologies.	**K1-I**	Lectures, problem-solving, discussions.	Homework, discussions, exams.
1.2	Comprehend digital image processing, image quality, and their impacts on diagnostic accuracy.	**K2-P**	Presentations, quizzes, problem-solving.	Quizzes, problem-solving exercises.
1.3	Recognize biological effects and safety considerations associated with imaging modalities.	**K3-M**	Lectures, oral questions, quizzes.	Quizzes, oral presentations, problem-solving.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	Evaluate internal effective doses for organs in nuclear medicine.	**S1-P**	Lectures, case studies.	Exam questions focused on dose evaluation.
2.2	Apply mathematical expressions to calculate external and internal doses.	**S2-M**	Brainstorming, discussions.	Quizzes, exams, post-lecture discussions.
2.3	Integrate IT-based solutions into radiation dose calculations.	**S3-M**	Discussions, active learning.	Quizzes, exams, practical exercises.
3.0	**Values, autonomy, and responsibility**			
3.1	Analyze and manage obtained radiation data.	**V2-P**	Case studies, active learning.	Evaluate reports and teamwork.
3.2	Make quick and informed decisions during data acquisition.	**V1-M**	Homework, report preparation, presentations.	Evaluate student reports and presentations.

C. Course Content:

No	List of Topics	Contact Hours
65.	**Introduction to digital image processing** Digital images Image quality Basic image operations	6
66.	**Radiography** X-rays X-ray detectors Dual-energy imaging Image quality Equipment Biologic effects and safety Future expectations	6

67.	**X-ray computed tomography** X-ray detectors in CT Cardiac CT Dual-energy CT Image quality Equipment Biologic effects and safety Future expectations	6
68.	**Magnetic resonance imaging** Physics of the transmitted signal Interaction with tissue Signal detection and detector Image quality Equipment Biologic effects and safety Future expectations	6
69.	**Ultrasound imaging** Physics of acoustic waves Generation and detection of ultrasound Gray scale imaging Doppler imaging Image quality Equipment Biologic effects and safety Future expectations	6
70.	**Medical image analysis** Manual analysis Automated analysis Computational strategies for automated medical image analysis Pixel classification	6

	Geometric model matching using a transformation matrix Flexible geometric model matching Validation Future expectations	
71.	**Visualization for diagnosis and therapy** 2D visualization 3D rendering Virtual reality User interaction Intraoperative navigation Augmented reality Future expectations	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
16.	Exercises & Homeworks	All weeks	20 %
17.	Midterm's exam	8th week	30 %
18.	Final Exam (theoretical)	18th week	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	1-Fundamentals of Medical Imaging Second Edition Paul Suetens Cambridge University Press 2009 ISBN 978-3-319-25380-0 2. Medical Imaging Processing: Concepts and applications, C.R. Pattel, 2014, Kindel edition. 3 -Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge University Press 2009, ISBN-13 978-0-511-53343-3.
Supportive References	Quantitative Analysis in Nuclear Medicine Imaging Habib Zaidi 2006 Springer ScienceBusiness Media, Inc. ISBN-13: 978-0387-23854
Electronic Materials	www.iomp.org www.aapm.org www.afomp.org

Other Learning Materials	The following journals are recognized as official publications of the IOMP: 1. Physics in Medicine and Biology 2. Physiological Measurement 3. Medical Physics 4. Journal of Applied Clinical Medical Physics 5. Medical Physics International

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	19. Classrooms: Equipped with whiteboards, projectors, and seating for interactive theoretical discussions. 20. Seminar Rooms: Spaces for collaborative discussions, presentations, and guest lectures. 21. Simulation Rooms: For visualizing quantum phenomena using computational tools.
Technology equipment (Projector, smart board, software)	40. Projector and Smart Board: For presenting derivations, diagrams, and visual simulations of quantum field interactions.
Other equipment (Depending on the nature of the specialty)	41. Access to Online Resources: Journals, databases, and virtual lecture platforms for advanced research.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Academic Program Coordinator	Conduct mid-term and end-of-term surveys to gather students' perceptions of teaching methods, clarity of

Assessment Areas/Issues	Assessor	Assessment Methods
		explanations, and engagement.
Effectiveness of students' assessment	Course Instructor	Compare assessments (quizzes, assignments, projects) with course learning outcomes (CLOs) to ensure alignment.
Quality of learning resources	Course Instructor	Track student engagement with electronic materials (e.g., downloads, page visits) and physical resources.
The extent to which CLOs have been achieved	External Academic Reviewer	Collect feedback from graduates on the applicability of course content and learning outcomes in research or professional practice.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

Course Title:	**Applications in Medical Physics**
Course Code:	
Program:	**Master of Science in Medical Physics**
Department:	**Physics**
College:	**Sciences**
Institution:	**Umm Al-Qura University**
Version:	**2nd**
Last Revision Date:	**January 2025**

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3 hourse)				
2. Course type				
A.	☐University	☐College	☒ Department	☒ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (2nd year/third semester)				
4. Course General Description:				
This course introduces MATLAB software and its applications in medical physics, focusing on performing essential operations with 1D, 2D, and 3D data commonly used in the field. It covers the core applications of DICOM, including data structure, modification, and the construction of DICOM information. The course also delves into the specifics of the DICOM RT (Radiotherapy) module and concludes with methods for performing and automating quality control tests for various medical imaging devices.				
5. Pre-requirements for this course (if any):				
6. Pre-requirements for this course (if any):				
7. Course Main Objective(s):				
42. Develop proficiency in MATLAB programming and its application to solve problems in medical physics, including handling 1D, 2D, and 3D data. 43. Understand the structure and application of DICOM data, including DICOM RT modules, and learn to modify and process DICOM information effectively. 44. Perform and automate quality control tests for medical imaging devices, ensuring accuracy and reliability in clinical applications.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%

No	Mode of Instruction	Contact Hours	Percentage
2	E-learning		
3	Hybrid 72. Traditional classroom 73. E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
74.	**Lectures**	45
75.	**Laboratory/Studio**	
76.	**Field**	
77.	**Tutorial**	
78.	**Others (specify).....**	
	Total	45

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	Identify MATLAB tools and environment for medical physics.	K1-P	Lectures, discussions, and computer simulations. Lectures, problem-solving exercises, and guided practice. Interactive demonstrations and hands-on exercises.	**1-** Homework **2-** Question – answer session in class. **3-** Quiz, midterm and final exam
1.2	Write programs to solve routine problems in medical physics.	K2-P		
1.3	Visualize medical data using MATLAB graphical tools.	K3-M		
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	Develop basic programming skills for medical applications.	**S1-I**	Lectures, discussions, and guided exercises. Problem-solving sessions and collaborative exercises. Hands-on practice with DICOM data and projects.	Quizzes, exams, homework. Problem-solving tasks, midterm, final exams. Practical tasks, project evaluations.
2.2	Solve medical physics problems using MATLAB.	**S2-P**		
2.3	Modify DICOM data for specific medical physics tasks.	**S4-M**		
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate self-learning responsibility in programming.	**V1-P**	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Encourage the student to look for the information in different references.	**1-** Homework **2-** Question – answer session in class. **3-** Quiz, midterm and final exam
3.2	Select effective methods for routine programming in medical physics.	**V2-M**		
...				

C. Course Content:

No	List of Topics	Contact Hours
79.	MATLAB fundamentals	9
80.	Medical physics related data types	6
81.	Importing and manipulating DICOM data	9
82.	Reconstructing and modifying DICOM RT data	6
83.	Automating quality control test	9
84.	Analyzing radiation dose structured reports	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
22.	Midterm	8th week	30%
23.	Research assignment	11th week	20%
24.	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	**Diagnostic Radiology Physics with MATLAB: A Problem-Solving Approach** 45. *Authors*: Johan Helmenkamp, Robert Bujila, Gavin Poludniowski 46. *Edition*: 1st Edition (2021) 47. *Publisher*: CRC Press 48. *ISBN*: 978-0367642624 49. *Description*: This book provides a foundation for teaching and learning programming for medical physicists and other professionals in radiology. It focuses on practical skills for implementing MATLAB as an everyday tool in medical physics, offering real-world examples and solutions. Routledge
Supportive References	• **Scientific Computing with MATLAB and Octave** 50. *Authors*: Alfio Quarteroni, Fausto Saleri, Paola Gervasio 51. *Edition*: 4th Edition (2014) 52. *Publisher*: Springer 53. *ISBN*: 978-3642453663 54. *Description*: This textbook introduces scientific computing, illustrating numerical methods for computer-based solutions to mathematical problems. It covers topics such as computing zeros, extrema, integrals of continuous functions, solving linear systems, and constructing accurate approximations for differential equations.

	SpringerLink • **MATLAB: A Practical Introduction to Programming and Problem Solving** 55. *Author*: Stormy Attaway 56. *Edition*: 4th Edition (2017) 57. *Publisher*: Butterworth-Heinemann 58. *ISBN*: 978-0128045251 59. *Description*: This book offers a comprehensive introduction to MATLAB, focusing on programming and problem-solving skills. It covers the fundamentals of MATLAB programming, including syntax, functions, and applications, with practical examples and exercises.
Electronic Materials	https://uk.mathworks.com/matlabcentral/
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	25. Classrooms: Equipped with whiteboards, projectors, and seating for interactive theoretical discussions. 26. Seminar Rooms: Spaces for collaborative discussions, presentations, and guest lectures. 27. Simulation Rooms: For visualizing quantum phenomena using computational tools.
Technology equipment (Projector, smart board, software)	60. Projector and Smart Board: For presenting derivations, diagrams, and visual simulations of quantum field interactions.
Other equipment (Depending on the nature of the specialty)	61. Access to Online Resources: Journals, databases, and virtual lecture platforms for advanced research.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Academic Program Coordinator	Conduct mid-term and end-of-term surveys to gather students' perceptions of teaching methods, clarity of explanations, and engagement.
Effectiveness of students' assessment	Course Instructor	Compare assessments (quizzes, assignments, projects) with course learning outcomes (CLOs) to ensure alignment.
Quality of learning resources	Course Instructor	Track student engagement with electronic materials (e.g., downloads, page visits) and physical resources.
The extent to which CLOs have been achieved	External Academic Reviewer	Collect feedback from graduates on the applicability of course content and learning outcomes in research or professional practice.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	

Course Title:	**Medical Radiation Protection**
Course Code:	
Program:	**Master of Science in Medical Physics**
Department:	**Physics**
College:	**Sciences**
Institution:	**Umm Al-Qura University**
Version:	**2nd**
Last Revision Date:	**January 2025**

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3 hourse)				
2. Course type				
A.	☐University	☐College	☒ Department	☒ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: (2nd year/third semester)				
4. Course General Description:				
This course provides comprehensive knowledge of radiation protection, focusing on international standards, legislation, and regulations for both ionizing and non-ionizing radiation. It covers personal dosimetry methods, the use of radiation protection instruments, and best practices for the safe handling of radioactive materials.				
5. Pre-requirements for this course (if any)**:**				
6. Pre-requirements for this course (if any)**:**				
7. Course Main Objective(s):				
62. Explain the risks associated with the use of ionizing and non-ionizing radiation in medical applications. 63. Provide a comprehensive understanding of the principles and practices of radiation protection in medical physics. 64. Equip students with the knowledge to apply radiation protection techniques in various medical settings effectively.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid 85. Traditional classroom 86. E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
87.	**Lectures**	45
88.	**Laboratory/Studio**	
89.	**Field**	
90.	**Tutorial**	
91.	**Others (specify)……**	
	Total	45

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	Explain the principles and definition of quantities of radiation protection	**K1-I**	Start each chapter by general idea of the meaning of exposure Demonstrate the course information and principles through lectures. Describing radiation protection concepts with solving problems Describing the procedure of	1.Homework Interactive 2.discussion 3.Short exam1 4.Short exam2 Final exam
1.2	Describe how to transport radioactive and manage radioactive waste and emergency situation	**K2-P**		1.Presentations 2.Quizzes 3.. Problem solving

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	Valuing the professional conduct of radiation protection in Radiology	**K3-M**	calculation the internal dose using Medical Internal Radiation Dose.	1. Oral questions 2. Presentations 3 .Quizzes 4.Problem solving
2.0	**Skills**			
2.1	Evaluating the application of radiation protection principles in medical facilities	**S1-P**	Lectures	Exam must contain questions that can measure these skills.
2.2	Identify and aware the medical exposure in radiotherapy, diagnostic radiology and nuclear medicine	**S2-P**	Brain storming	Quiz and exams Discussions after the lecture
2.3	Integrate information technology (IT) based solution into radiation.	**S3-M**	Discussion	Quiz and exams Discussions after the lecture
3.0	**Values, autonomy, and responsibility**			
3.1	Annalise and obtained data and how to manage it.	**V2-P**	Case Study - Active learning	Evaluate the scientific values of reports. Evaluate the work in team
3.2	Make a certain decision fast, especially during data acquisition.	**V1-M**	Homework (preparing a report on some topics related to the course depending on web sites).	Evaluate the efforts of each student in preparing the report. Evaluation of student presentations

C. Course Content:

No	List of Topics	Contact Hours
92.	**Introduction to radiation protection** Goals of radiation protection Concepts of radiation protection Justification and responsibility for image procedures Aa low as reasonably achievable (ALARA principles) Patient protection and patient education	6
93.	**Radiation quantities and units** Historical evolution of radiation quantities and units Radiation quantities and their SI units and units of measurements	3
94.	**Radiation monitoring** Personnel monitoring Personnel dosimeters Radiation survey instruments for area monitoring. Instruments used to measure X-ray Exposure in Radiology.	6
95.	**Dose limits for exposure to ionizing radiation** Basis of effective dose limiting system Radiation protection standards organizations Radiation safety program Basis for the effective dose limiting system Occupational and non-occupational dose limits	6
96.	**Equipment design for radiation protection** Radiation safety features of radiographic equipment Fluoroscopic, digital fluoroscopy and mobile C-Arm, devices and accessories.	3
97.	**Management of patient radiation dose during some X-ray procedures** Protection shielding Technical exposure factors protecting the pregnant Pediatric considerations during radiographic imaging	6
98.	**Methods for reduction of patient dose in Computed Tomography** Methods for reduction of patient dose in Computed Tomography	3

	Computed Tomography dose parameters Goal of computed tomography imaging from a radiation protection point of view Patient dose in mammography.	
99.	**Management of imaging personnel radiation dose during diagnostic X-ray procedures** Annual limit for occupational exposed personnel Dose reduction methods and techniques Protection for pregnant personnel Basic principles of radiation protection for personnel exposure Protection during fluoroscopic procedures Protection during mobile radiographic examinations. Protection during C-Arm fluoroscopy	6
---	**Emergency exposure situations and emergency preparedness and response** Basic Safety Standards requirements General principles Planning basis Protection strategy Protective actions and other response actions Emergency management system Radiological assessment Medical response Providing instructions and communicating with the public Role of IAEA	6
Total		

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
28.	Exercises & Homeworks	All weeks	20 %
29.	Midterm's exam	8th week	30 %
30.	Final Exam (theoretical)	18th week	50 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
...			

*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 Protection in Medical Radiography** 65. *Authors*: Mary Alice Statkiewicz Sherer, Paula J. Visconti, E. Russell Ritenour, Kelli Welch Haynes 66. *Edition*: 8th Edition (2017) 67. *Publisher*: Elsevier 68. *ISBN*: 978-0323446662 69. *Description*: This comprehensive text promotes the safe use of ionizing radiation in all imaging modalities, covering the effects of radiation on humans at the cellular and systemic levels, regulatory and advisory limits for human exposure, and the implementation of radiation safety practices for patients and personnel. Amazon • **Radiation Protection in Medical Physics** 70. *Editors*: Yves Lemoigne and Alessandra Caner 71. *Edition*: 1st Edition (2011) 72. *Publisher*: Springer 73. *ISBN*: 978-9400702462 74. *Description*: This book introduces the fundamental aspects of radiation protection in medical physics, covering general radiation protection principles, radiobiology principles, and radiation protection applications in hospital medical physics.
Supportive References	Leonie Munro. Basics of radiation protection for every day use. How to achive ALARA: working tips and Guidelines, WHO, 2004.
Electronic Materials	www.iomp.org www.aapm.org www.afomp.org
Other Learning Materials	The following journals are recognized as official publications of the IOMP: 1. Physics in Medicine and Biology 2. Physiological Measurement 3. Medical Physics

	4. Journal of Applied Clinical Medical Physics 5. Medical Physics International

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	31. Classrooms: Equipped with whiteboards, projectors, and seating for interactive theoretical discussions. 32. Seminar Rooms: Spaces for collaborative discussions, presentations, and guest lectures. 33. Simulation Rooms: For visualizing quantum phenomena using computational tools.
Technology equipment (Projector, smart board, software)	75. Projector and Smart Board: For presenting derivations, diagrams, and visual simulations of quantum field interactions.
Other equipment (Depending on the nature of the specialty)	76. Access to Online Resources: Journals, databases, and virtual lecture platforms for advanced research.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Academic Program Coordinator	Conduct mid-term and end-of-term surveys to gather students' perceptions of teaching methods, clarity of explanations, and engagement.
Effectiveness of students' assessment	Course Instructor	Compare assessments (quizzes, assignments, projects) with course learning outcomes (CLOs) to ensure alignment.
Quality of learning resources	Course Instructor	Track student engagement with electronic materials (e.g.,

Assessment Areas/Issues	Assessor	Assessment Methods
		downloads, page visits) and physical resources.
The extent to which CLOs have been achieved	External Academic Reviewer	Collect feedback from graduates on the applicability of course content and learning outcomes in research or professional practice.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	