Kingdom of Saudi Arabia
Umm Al-Qura University
Faculty of Applied Science
Physics Department

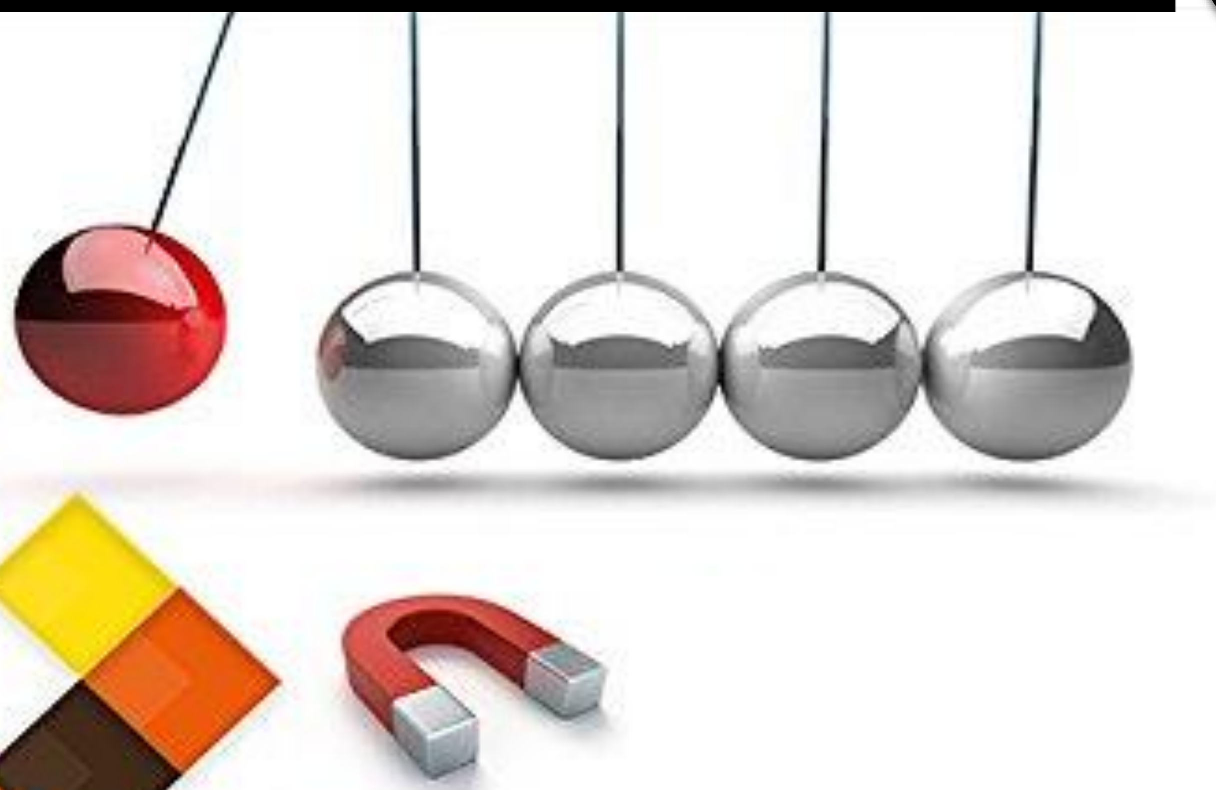
المملكة العربية السعودية
جامعة أم القرى
كلية العلوم التطبيقية
قسم الفيزياء

كلية العلوم التطبيقية
Faculty of Applied Sciences

Module Handbook of Medical Physics Courses' Specifications

Current Study Plan 1437

Course Specification Handbook



Curriculum of Study Plan 1437

بسم الله الرحمن الرحيم

وقل اعملوا فسيرى الله عملكم ورسوله والمؤمنون

معالي مدير الجامعة
أ.د. عبدالله بن عمر بافيل

سعادة وكيل الكلية للتطوير الجامعي
الدكتور/ فهد الهاشمي

سعادة وكيل الكلية
د./ حاتم الطس

سعادة وكيلة الكلية لفرع الطالبات
د/ رجاء معتوق

سعادة وكيل الكلية للشئون الاكاديمة
الدكتور/ حسين ابو الريش

سعادة وكيل الكلية للدراسات العليا
أ.د./ باسم حسين اصغر

سعادة رئيس قسم الفيزياء
الدكتور/ فهد الهاشمي

سعادة وكيلة القسم لفرع الطالبات
الدكتوره/ نهى فلمبان

مقدمة

الحمد لله رب العالمين والصلاة والسلام على سيدنا ونبينا محمد وعلى آله واصحابه والتابعين الى يوم الدين،

أنشئ قسم الفيزياء في عام 1385/1384 ه الموافق 1965/1964م، كتوأم لقسم الرياضيات، وذلك عندما صدرت أول لائحة لكلية التربية بجامعة الملك عبد العزيز شطر مكة المكرمة، وقد تخرجت عدة دفعات على نظام التخصص المزدوج (فيزياء ورياضيات).

استمر العمل على هذا النظام لمدة عشر سنوات، حتى عام 1395/1394ه حيث تم فصل قسم الفيزياء عن قسم الرياضيات، وأصبح قسما قائما بذاته يمنح درجة البكالوريوس في الفيزياء والفيزياء الطبية.

وفي عام 1397/1396ه، ادخل نظام الساعات المعتمدة على جامعة الملك عبد العزيز شطر مكة المكرمة، وأصبح القسم يقدم مقرراته وفقا لنظام الساعات المعتمدة. ويمنح درجة البكالوريوس في الفيزياء. وفى عام 1401/1400 ه تأسست جامعة أم القرى بمكة المكرمة، ثم انشئت كلية العلوم التطبيقية واصبح القسم تابعا لها. وأصبح يمنح درجة البكالوريوس في الفيزياء والفيزياء الطبية.

وهناك ثلاث خطط دراسية من أهم الخطط بالنسبة للقسم، وهي الخطة 19، والخطة 33، والخطة 37، والأخيرة هي الأحدث وهى قيد التنفيذ الأن، وفيما يلى نستعرض توزيع المقررات وتوصيف البرنامج وتوصيف المقررات لبرنامج الفيزياء الخطة 37.

وفقنا الله وإياكم الى ما يحبه و يرضاه،،

قســم الفيزياء

The Description of the Medical Physics Curriculum 1437 A.H

(Credit hours 136 h)

Course Code	Course Title	Required or Elective	Credit Hours	College or Department
First year Level 1 (Semester 1)				
4041101	Calculus (1)	R	4	Faculty of Applied Science / Dept. of Mathematics
4021101	General Chemistry	R	4	Faculty of Applied Science / Dept. of Chemistry
7004101	English Language - General	R	4	English Language Institute
605101	Holy Quran I	R	2	
601101	Islamic Culture I	R	2	
Total			16	
Level 2 (Semester 2)				
4031101	General Physics	R	4	Faculty of Applied Science / Dept. of Physics
4011101	General Biology	R	4	Faculty of Applied Science / Dept. of Biology
7004102	English for Science	R	4	English Language Institute
501101	Arabic Language	R	2	Faculty of Arabic Language
102101	The Biography of the Prophet Mohammad (PBUH)	R	2	
Total			16	
Second year Level 3 (Semester 3)				
4032280	Fundamentals of Medical physics	R	4	Faculty of Applied Science / Dept. of Physics
4032102	General physics (2)	R	4	Faculty of Applied Science / Dept. of Physics

4032121	Electricity and magnetism	R	4	Faculty of Applied Science / Dept. of Physics
4041502	Differentiation and Integration (2)	R	4	Faculty of Applied Science / Dept. of Mathematics
4012312	Cell Biology	R	2	Faculty of Applied Science / Dept. of Biology
Total			18	
Level 4 (Semester 4)				
4032293	Biomechanics	R	3	Faculty of Applied Science / Dept. of Physics
4032141	Theoretical Methods in Physics(1)	R	4	Faculty of Applied Science / Dept. of Physics
4032150	Modern Physics	R	4	Faculty of Applied Science / Dept. of Physics
4013331	Biology-Physiology	R	3	Faculty of Applied Science / Dept. of Biology
605201	Holy Quran II	R	2	
601201	Islamic Culture II	R	2	
Total			18	
Third year Level 5 (Semester 5)				
4033290	Physics of Medical Ultrasound	R	2	Faculty of Applied Science / Dept. of Physics
4033281	Physics of medical laser	R	2	Faculty of Applied Science / Dept. of Physics
4033285	Radiation Medical physics(1)	R	4	Faculty of Applied Science / Dept. of Physics
4033298	Physics of cell membrane & Macromolecules	R	2	Faculty of Applied Science / Dept. of Physics
4033145	Quantum Mechanics (1)	R	4	Faculty of Applied Science / Dept. of Physics

601301	Islamic Culture III	R	3	
Total			17	
Level 6 (Semester 6)				
4033283	Health Physics	R	3	Faculty of Applied Science / Dept. of Physics
4033292	Radiation Medical physics(2)	R	4	Faculty of Applied Science / Dept. of Physics
4034170	Solid State Physics(1)	R	4	Faculty of Applied Science / Dept. of Physics
4033132	Electromagnetism (1)	R	3	Faculty of Applied Science / Dept. of Physics
4034160	Nuclear Physics	R	4	Faculty of Applied Science / Dept. of Physics
Total			18	
Fourth year Level 7 (Semester 7)				
4034291	Computer Applications in Medical physics	R	2	Faculty of Applied Science / Dept. of Physics
4034289	Physics of Medical Imaging	R	3	Faculty of Applied Science / Dept. of Physics
4034286	Physics of radiotherapy	R	4	Faculty of Applied Science / Dept. of Physics
4034295	Physics of Nuclear Medicine	R	4	Faculty of Applied Science / Dept. of Physics
4034296	Physic of Bio-Material	R	3	Faculty of Applied Science / Dept. of Physics
605301	Holy Quran III	R	2	
Total			18	
Level 8 (Semester 8)				
4034998	Hospital Training	R	11	
605401	Holy Quran IV	R	2	
601401	Islamic Culture IV	R	2	

Total	**15**

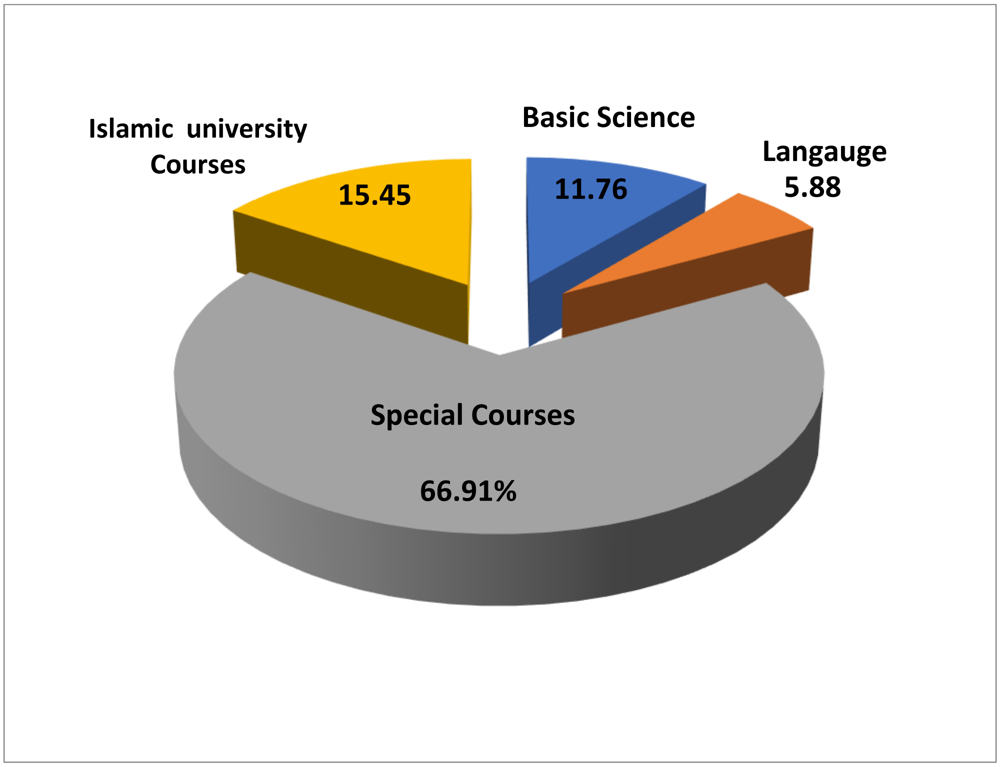


Figure 1: The Curriculum Structure of the program.

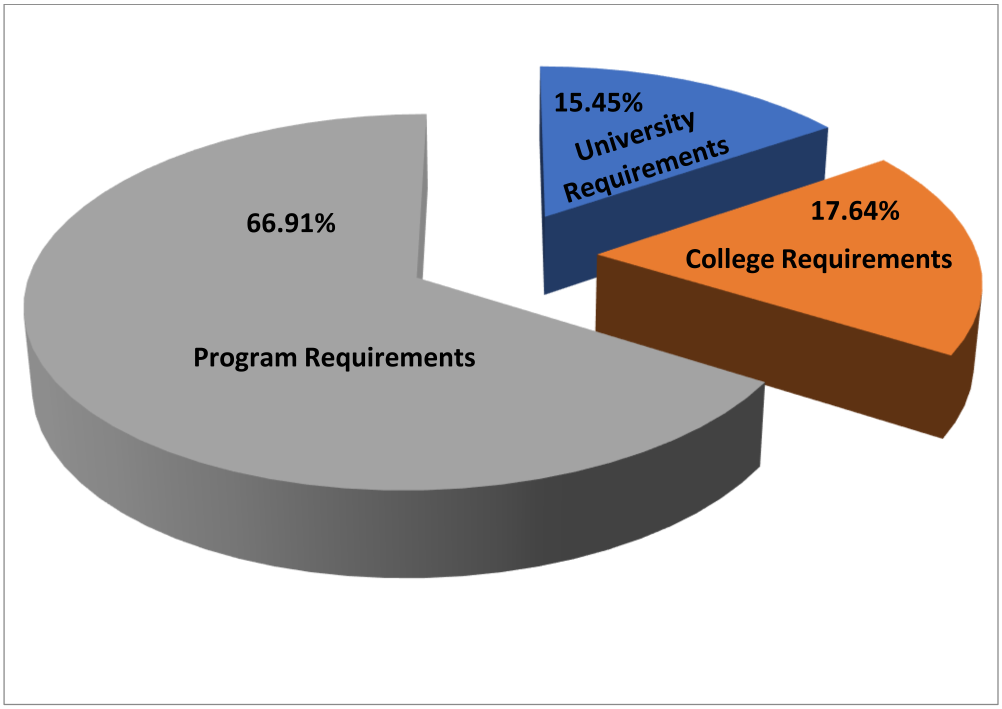


Figure 2: Curriculum Distribution.

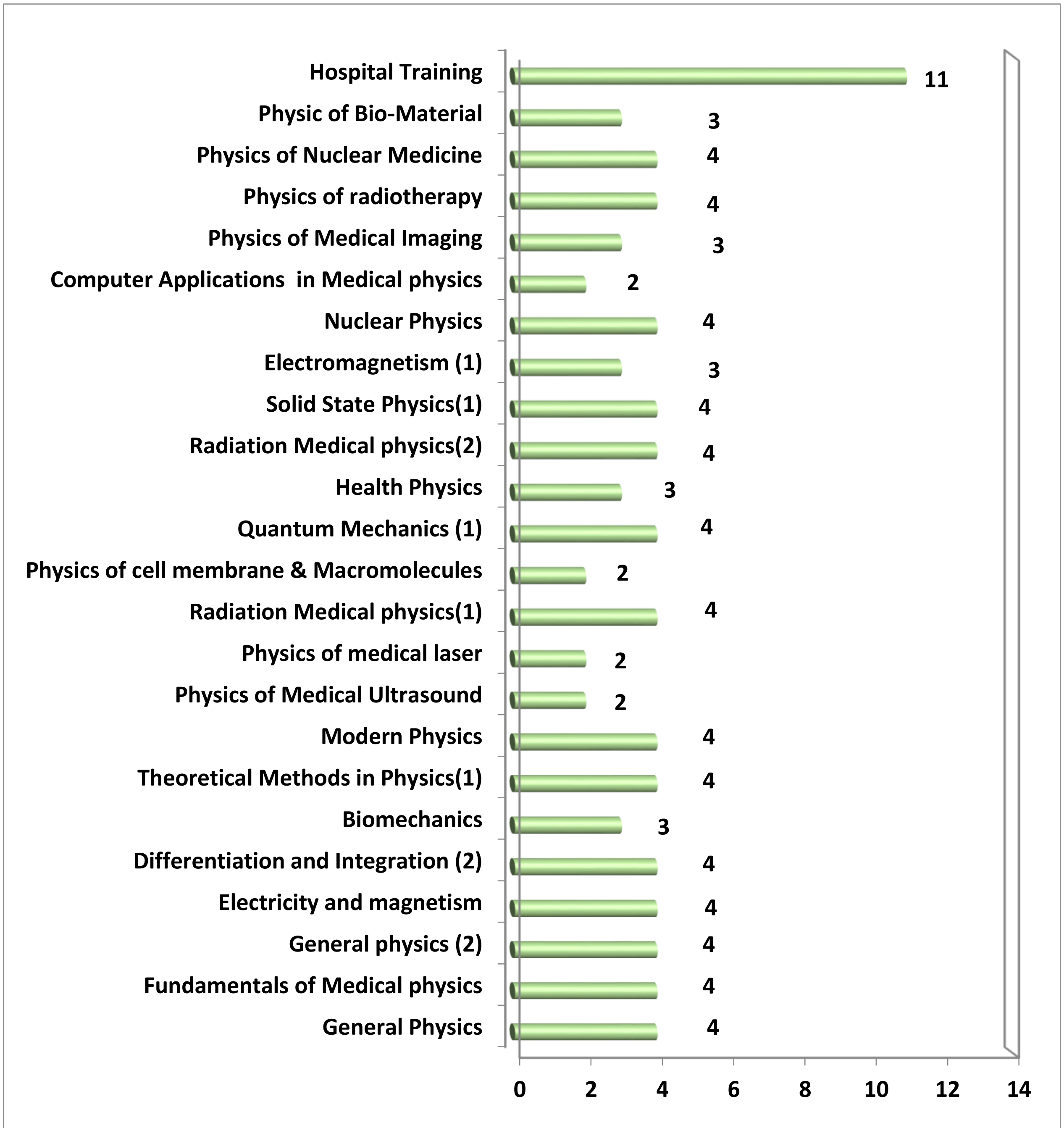
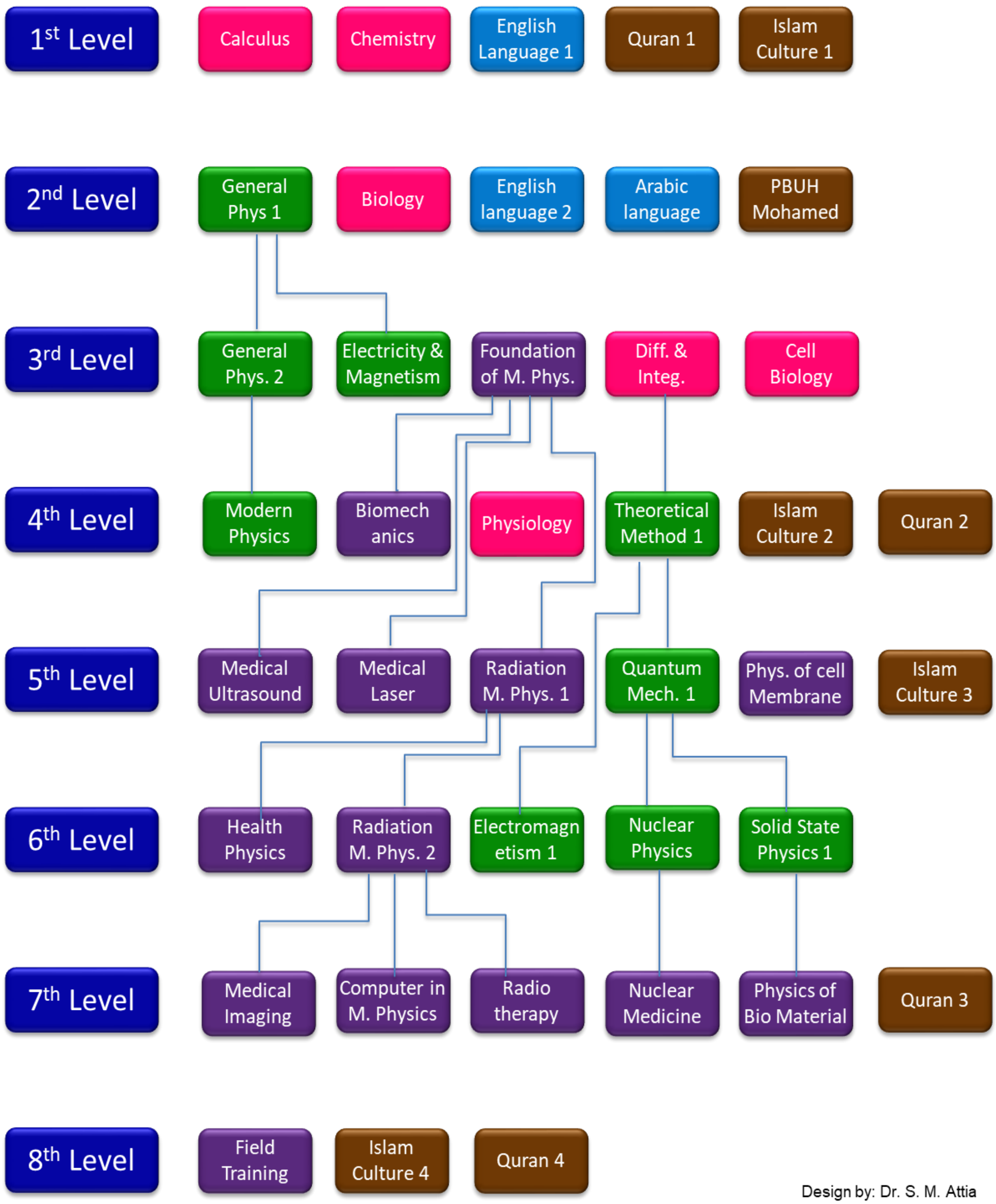


Figure 3: Credit hours distribution.

Curriculum Scheme for Medical Physics Program Plan (37)



Design by: Dr. S. M. Attia

Courses' Specifications

Plan 37

Level One

Calculus 4041101-4

General Chemistry (1) 4021101-4

COURSE SPECIFICATION

Course Title:	**Calculus**
Course Code:	**30111101-4**
Program:	**BSc. Medical Physics**
Department:	**Mathematical Science**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4 hours							
2. Course type							
a.	University	☒	College	☐	Department	☐	Others ☐
b.	Required	☒	Elective	☐			
3. Level/year at which this course is offered: First Level / First Year							
4. Pre-requisites for this course (if any)**:** Does not exist.							
5. Co-requisites for this course (if any)**:** Does not exist.							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4 hours per week	100%
2	Blended	0	0%
3	E-learning	0	0%
4	Correspondence	0	0%
5	Other	0	0%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	(4 hours) x (15 weeks)
2	Laboratory/Studio	0
3	Tutorial	0
4	**Others** (specify)	0
	Total	60 hours
Other Learning Hours*		
1	Study	(1 hour) x (15 weeks)
2	Assignments	(1 hour) x (15 weeks)
3	Library	(1 hour) x (15 weeks)
4	Projects/Research Essays/Theses	0
5	**Others** (specify)	0
	Total	45 hours

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Calculus is the first of the required courses in the mathematics program. This course provides a unique introduction to a course in single-variable calculus. Key topics of the course include real numbers, functions and graphing, limits and continuity, derivatives, derivative applications, integrals, and applications of integration. Concepts of differential and integral calculus is applied to trigonometric, inverse trigonometric, and transcendental functions.

2. Course Main Objective

The primary objective of the course is to introduce students to the concepts of calculus and to develop the student's confidence and skill in dealing with mathematical expressions. To achieve this goal, the course will help the student understand the following basic concepts: limits, continuity and derivatives involving real-valued functions of one variable (including algebraic, trigonometric, exponential, and logarithmic functions).

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Recognize the characteristics of a function expressed in symbolic or graphic form.	
1.2	Outline the definitions of limits and continuity a single-variable function and their theorems.	
1.3	List the different rules, formulas and theorems of differentiation of real functions.	
1.4	Define the basic concepts and techniques of integration of polynomial, rational, transcendental and trigonometric functions.	
2	**Skills :**	
2.1	Analyze functions represented in a variety of ways: graphical, numerical or analytical.	
2.2	Determine the limits of functions and their continuity at points or on intervals.	
2.3	Calculate the derivative of various type of functions using the rules and techniques of differentiation.	
2.4	Apply the concept of derivative to completely analyze graph of a function.	
2.5	Evaluate integrals of real functions using basic rules and techniques of integration.	

	CLOs	Aligned PLOs
3	**Competence:**	
3.1	Apply the computational and conceptual principles of calculus to the solutions of various mathematical problems.	
3.2	Use graphical information and symbolic expression simultaneously in solving problems.	
3.3	Justify the choice of different steps in problem resolution procedure.	

C. Course Content

No	List of Topics	Contact Hours
1	**Brief Review** - Real numbers. - Exponents and Radicals. - Polynomials: Basic Operations and Factoring. - Solving Equations. - Rational Expressions: Basic Operations. - Inequalities. - Absolute Values.	8
2	**Functions** - Definition of Functions (Domain and Range) - Graphs of Functions - Operations on Functions - Trigonometric Functions and Identities.	8
3	**Limits** - Introduction to Limits - Theorems on limits - Limit from Right and from Left - Definition of Continuity	8
4	**Differentiation** - Definition of Derivative (Using Limits) - Rules and Theorems for Finding Derivatives - Derivative of Trigonometric Functions - Chain Rule - Higher Order Derivatives - Implicit Differentiation.	16
5	**Applications of the derivative** - Maxima and Minima - Monotonicity - Local Maxima and Minima - Concavity	12

	- Sketching Graphs.	
6	**Integration** - Integration of Functions - Definite Integrals.	8
Total		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the characteristics of a function expressed in symbolic or graphic form.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
1.2	Outline the definitions of limits and continuity a single-variable function and their theorems.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
1.3	List the different rules, formulas and theorems of differentiation of real functions.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
1.4	Define the basic concepts and techniques of integration of polynomial, rational, transcendental and trigonometric functions.	Lecture. Memorization.	Exams (Midterm and Final). Quizzes.
2.0	**Skills**		
2.1	Analyze functions represented in a variety of ways: graphical, numerical or analytical.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.2	Determine the limits of functions and their continuity at points or on intervals.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.3	Calculate the derivative of various type of functions using the rules and techniques of differentiation.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.4	Apply the concept of derivative to completely analyze graph of a function.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
2.5	Evaluate integrals of real functions using basic rules and techniques of integration.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Apply the computational and conceptual principles of calculus to the solutions of various mathematical problems.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
3.2	Use graphical information and symbolic expression simultaneously in solving problems.	Lecture. Small group work.	Exams (Midterm and Final). Homework.
3.3	Justify the choice of different steps in problem resolution procedure.	Lecture. Small group work.	Exams (Midterm and Final). Homework.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Test (1)	6th week	20%
2	Midterm Test (2)	12th week	20%
3	Homework and Quizzes	During the semester	10%
4	Final Examination	End of semester	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Each group of students is assigned to a faculty member where he or she will provide academic advising. All faculty members are required to be in their offices outside teaching hours. Each faculty member allocates at least 4 hours per week to give academic advice and to answer to the questions of students about concepts studied during the lectures.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Calculus (9th Edition), Dale Varberg, Edwin Purcell and Steven Rigdon, Prentice Hall (2006).
Essential References Materials	Mathematics for preparatory year program (Book1), Oxford University Press (2013).

Electronic Materials	None.
Other Learning Materials	None.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Large classrooms that can accommodate more than 50 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment.	Students	Direct
Quality of learning resources.	Students	Direct
Extent of achievement of course learning outcomes.	Faculty member	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Council of the Mathematics Department
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**General Chemistry**
Course Code:	**30111101-4**
Program:	**BSc. Medical Physics**
Department:	**Chemistry**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:				
2. Course type				
a.	University ☐	College ■	Department ☐	Others ☐
b.	Required ■	Elective ☐		
3. Level/year at which this course is offered: **1st level**				
4. Pre-requisites for this course (if any): ---------------------				
5. Co-requisites for this course (if any):--------------				

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	
2	Blended		
3	E-learning		
4	Correspondence		
5	Other	45	

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	30
2	Laboratory/Studio	45
3	Tutorial	
4	Others (specify)	
	Total	75
Other Learning Hours*		
1	Study	30
2	Assignments	5
3	Library	5
4	Projects/Research Essays/Theses	
5	Others (specify)	
	Total	45

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description: This course is an introductory chemistry course designed to prepare students for college level chemistry courses. The course introduces some basic principles of physicl, organic and inorganic chemistry.

2. Course Main Objective

The course introduces some basic principles of physicl, organic and inorganic chemistry.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Knows International system of units	K2
1.2	State laws that describe the behavior of ideal gases.	K3
1.3	State Faraday's laws	K3
1.4	State concentrations units	K2
1.5	Mention the first law of thermodynamics.	K2
1.6	List the factors affecting equilibrium position and equilibrium concentration.	K2
2	**Skills :**	
2.1	Summarize gases laws	S2
2.2	Compare between ideal and real gases	S3
2.3	Apply Hess's law for the calculation of heat of reaction.	S3
2.4	Apply Faraday's laws for calculating the amount deposited at electrodes	S3
2.5	Predict the spontaneity of chemical reaction.	S2
3	**Competence:**	
3.1	Manage resources, time and collaborate with members of the group.	C1
3.2	Ability to work independently to handle Chemicals and perform laboratory illustrations safely.	C1
3.3	Ability to communicate results of work to classmates.	C1
3...	Communicate effectively with his lecturer and colleagues	C1
	Use university library and web search engines for collecting information and search about different topics .	C1

C. Course Content

No	List of Topics	Contact Hours
1	Units of measurements; SI- units, intensive and extensive properties, uncertainty in measurements (precision and accuracy).	2
2	Significant figures: Rounding significant figures, Using significant figures in addition, subtraction, multiplication and divisions.	2
3	States of matter and measurement, molecules and molecular compounds.	2
4	Gases	4
5	The mole, simple quantitative calculations with chemical reactions.	4
6	Basics of chemical equilibrium.	4
7	Acids and bases.	4
8	Thermochemistry.	4
9	Electrochemistry	4

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Knows International system of units	Lectures Scientific discussion	Quiz
1.2	State laws that describe the behavior of ideal gases.	Lectures Library visits Web-based study Library visits	Exam
1.3	State Faraday's laws	Lectures	Exam
1.4	State concentrations units	Lectures	Quiz
1.5	Mention the first law of thermodynamics.	Lectures Library visits Web-based study	Exam
1.6	List the factors affecting equilibrium position and equilibrium concentration.	Lectures Library visits	Exam
2.0	**Skills**		
2.1	Summarize gases laws	Lectures	Exam
2.2	Compare between ideal and real gases	Lectures Scientific discussion	Quiz
2.3	Apply Hess's law for the calculation of heat of reaction.	Lectures	Exam
2.4	Apply Faraday's laws for calculating the amount deposited at electrodes	Lectures Scientific discussion	Quiz
2.5	Predict the spontaneity of chemical reaction.	Lectures	Exam
3.0	**Competence**		
3.1	Manage resources, time and collaborate with members of the group.	Scientific discussion	long and short essays posters lab manuals
3.2	Ability to work independently to handle Chemicals and perform laboratory illustrations safely.	Scientific discussion	long and short essays

3.3	Ability to communicate results of work to classmates.	Scientific discussion	posters lab manuals
3.4	Communicate effectively with his lecturer and colleagues	Library visits	posters lab manuals
3.5	Use university library and web search engines for collecting information and search about different topics .	Library visits	long and short essays

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Class activities, Attendances and Duties	Throughout the Term	10%
2	Mid-Term Exam (s)	5-14	20%
3	Lab Activity and Final Exam on Lab	Throughout the Term	30%
4	Final Exam.(2 hours exam)	End of the Term	40%
5	Total	100%	

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Office hours for Faculty member

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	***P. Atkins* and *J. de Paula***, Physical Chemistry, 10th ed., 2006, New York.
Essential References Materials	Steven S. Zumdahl, Susan A. Zumdahl, 9th ed., 2009, New York.
Electronic Materials	Power point lectures.
Other Learning Materials	Course available online

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms, laboratories
Technology Resources (AV, data show, Smart Board, software, etc.)	data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Program Leaders	Direct
Extent of achievement of course learning outcomes	Faculty	Indirect
Quality of learning resources	Faculty	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Level Two

General Physics 4031101-4

General Biology 4011101-4

COURSE SPECIFICATION

Course Title:	**General Physics**
Course Code:	**4031101-4**
Program:	**Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 2/ 1st year	
4. Pre-requisites for this course (if any)**:**	
5. Co-requisites for this course (if any)**:**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	42
3	Tutorial	
4	**Others** (specify) exam and quizzes	6
	Total	93
Other Learning Hours*		
1	Study	89
2	Assignments	15
3	Library	
4	Projects/Research Essays/Theses (practical)	22
5	**Others** (specify) exam and quizzes	20
	Total	146

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover the principle of physics, such as measurements, work and energy, Newton's laws, heat, fluid mechanics, and light. This course will provide a conceptual and experimental background in physics sufficient to enable students to take courses that are more advanced in related fields.

2. Course Main Objective

After completing this course student should be able to:

1. Define the concepts of the measurements.
2. Define the concepts measuring length.
3. Define the concepts of measuring time.
4. Define the concepts of measuring weight.
5. Differentiate between the distance, the position, and the displacement.
6. Differentiate between the speed and the velocity.
7. Differentiate between the average velocity and the instantaneous velocity.
8. Define the concepts of the acceleration.
9. Differentiate between the average acceleration and the instantaneous acceleration.
10. Differentiate between the linear acceleration and the free fall acceleration.
11. Differentiate between the vectors and the scalars
12. Analyze the vectors into their components.
13. Calculate the multiplication of the vectors.
14. Define the concepts of the force.
15. Define the relation between the force and the acceleration.
16. Apply Newton's laws of motion.
17. Differentiate between the Work and the Energy.
18. Differentiate between the Energy and the power.
19. Define the Kinetic energy of the body.
20. Define the concept of the density of the body.
21. Define the concept of the pressure within the fluid.
22. Define the concept of Pascal principle.
23. Define the concept of Archimedes' principle.

24. Define the concept of Bernoulli's Equation.
25. Define the concept of the temperature
26. Differentiate between the Celsius Scale and Fahrenheit scale of temperature.
27. Define the laws of reflection through plane mirrors and spherical mirrors.
28. Define the laws of refraction through thin lenses.
29. Apply the laws of thin lenses.

In addition to these items, the students should gain practical skills through performance some experimental class.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	**Define** the physical quantities, physical phenomena, and basic principles of physics related to the course.	K1
1.2	**Express** the physical laws related to the course using mathematics.	K2
1.3	**Record** the physical quantity at the lab.	K3
2	**Skills:**	
2.1	**Calculate** the physical quantity related to the course.	S1
2.2	**Solve** physical problems	S1
2.3	**Drive** physics laws.	S2
2.4	**Determine** some physical quantity at the lab.	S3
3	**Competence:**	
3.1	**Work** effectively in groups.	C1
3.2	**Show** responsibility for self-learning to be aware with recent developments in physics.	C2

C. Course Content

No	List of Topics	Contact Hours
1	❖ **Measurement** 1- The physical quantities, standards, and Units. 2- The international system of units. 3- The Standard of time 4- The Standard of length 5- The Standard of Mass 6- Precision and significant figures. 7- Dimensional analysis.	**6**
2	❖ **Vectors** 1- Vectors and Scalars. 2- Adding vectors : graphical methods 3- Components of vectors.	**6**

	4- Adding vector: component method. 5- Multiplications of vectors. 6- Vector laws in physics.	
3	❖ **Motion in one dimension** 1- Particles kinematics. 2- Description of motion 3- Average velocity 4- Instantaneous velocity. 5- Accelerated motion. 6- Motion with Constant Acceleration 7- Freely falling Bodies. 8- Measuring free fall acceleration.	**3**
4	❖ **Motion in two and three dimensions** 1- Position, velocity, and acceleration. 2- Motion with constant acceleration 3- Projectile motion 4- Uniform circular motion 5- Velocity and acceleration vectors in circular motion	**3**
5	❖ **Force and motion** 1- Position, velocity, and accelerations 2- Motion with constant acceleration. . 3- Newtons first and second laws. 4- Forces. 5- Newtons second law 6- Newton's third law. 7- Units of force 8- Weight and mass 9- Measuring forces 10- Applying Newton's laws.	**6**
6	❖ **Work and Energy** 1. Work done by constant force. 2. Work done by a variable force: one dimensional case. 3. Work done by a variable force: two dimensional case. 4. Kinetic energy and work-energy theory. 5. Power.	**3**
7	❖ **Fluids Statics** 1. Fluids and Solids 2. Density and pressure. 3. Variation of density in a fluid at rest. 4. Pascal Principle. 5. Archimedes' Principle. 6. Surface tension.	**3**
8	❖ **Fluid dynamics** 1. General concepts of fluid flow	**3**

	2. Streamlines and the equation of continuity. 3. Bernoulli's Equation 4. Application of Bernoulli's Equation 5. Viscosity.	
9	❖ **Temperature, Heat and the first law of Thermodynamics.** 1. Heat: Energy in transit 2. Heat capacity and specific heat. 3. Heat capacity of solids 4. Temperature. 5. The Celsius and Fahrenheit Scales. 6. Heat transfer.	**6**
10	❖ **Reflection and refraction of light at plane surface** 1. Reflection and Refraction 2. Deriving the law of refrlection 3. Image formation by plane mirrors. 4. Deriving the law of refraction. 5. Total internal reflection.	**3**
11	❖ **Reflection and refraction of light at plane surface** 1. Spherical mirrors 2. Spherical refracting surfaces. 3. Thin lenses 4. Compound optical systems 5. Optical instruments	**3**
	❖ **Experimental part at the lab of general physics** 1. Safety Procedures in the Lab 2. Introduction and Graphing and Data Analysis 3. Fine Measurements 4. Force Table 5. Free Fall 6. Position and velocity and acceleration 7. Archimedes' Principle 8. Determination of Surface Tension of a liquid 9. Determining the Viscosity of a Fluid 10. Specific Heat 11. Determining the Refractive Index of a material 12. Focal length of a convex lens	**15**
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.1	Define the physical quantities, physical phenomena, and basic principles of physics related to the course.	1- Start each class with welcoming the students. 2- Give a general idea about the content of the lectrure. 3- Demonstrate the basic principles through lectures, using pictures and diagrams. 4- Discuss each item with the student through the lecture. 5- Lecturing method: Board, Power point. Discussions Brain storming	Solve some example during the lecture. Discussions during the lectures Exams: a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final) d) Oral exams
1.2	Express the physical laws related to the course using mathematics.		
1.3	Record the physical quantity at the lab.	1.teaching the student how to record the reading using different gauge correctly and safely at the lab. 2. teaching the stutnet how to desinge a suitable table to dominstrate the reading obtaind through the expermintal work.	• Tabulate the results, and • Dominstrate the results in a scientific Reports. • Lab assignments • Exam.
2.0	Skills		
2.1	Calculate the physical quantity related to the course.	1. Preparing main outlines for teaching. 2. Following some proofs. 3. Define duties for each chapter 4. Encourage the student to look for the information in different references.	1. Exams (Midterm, final, quizzes) 2. Asking about physical laws previously taught 3. Writing reports on selected parts of the course.
2.2	Solve physical problems		
2.3	Drive physics laws.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		5. Ask the student to attend lectures for practice solving problem.	4. Discussions of how to simplify or analyze some phenomena.
2.4	Determine some physical quantity at the lab.	1.Distribute the student at the lab as a teamwork. 3. Perform the paractical part of the experiments. 4. Collecting the data using different instruments. 5. Demonstrate the results as atables and grahps. 6.Analysing the results. 7.Determingin some physical quantity using the results. 8. Write the reports about the experiment. 9.Discussion with the student about the results	Writing scientific Reports. Lab assignments Exam.
3.0	Competence		
3.1	Write scinetif reports.	Inform the students about the followings: 1. How to search the internet and use the library. 2.How to cover missed lectures. 3.How to summarize lectures or to collect materials of the course. 4.How to solve difficulties in learning: solving problems – enhance educational skills.	1. Checking report on internet. 2. Discussion. 3. calculate the accuracy of the measure quantity. 4. Presenting the results.
3.2	**Show** responsibility for self-learning to be aware with recent developments in physics.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		5.Give students tasks of duties. 6.How to write reports. 7. How to work as a teamwork. 8.How to lead a Teamwork. 9. How to discuss with others .	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works	All weeks	5 %
2	Scientific activities	All weeks	5 %
3	Midterm Exam (theoretical)	9th week	20%
4	Lab. Reports (Practical)	11th week	10%
5	Final Exam (Practical)	15th week	10%
6	Final Exam (theoretical)	16th week	50%
7	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Halliday and Resnick and Jearal Walker, " Fundamental of Physics" 8 edition, Wiley, 2008.
Essential References Materials	Physics, 4th edition , By: Halliday, Resnick, and Krane, Wiley (1992) Physics , 4th edition, By: J. Walker (2010)
Electronic Materials	

Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board. There are enough laboratories for experimental physics, provided with air conditions, good data show, and experimental equipment.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Quashinear
Effectiveness of student assessment	Instructor	Exams
Extent of achievement of course learning outcomes	Instructor	Course report
Quality of learning resources	Instructor	Course report

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Physics Depratment, Faculty of Applied Science, Umm AlQura University
Reference No.	
Date	

Course Specification

Course Title:	General Biology
Course Code:	4011101-4
Program:	BSc Biology
Department:	Department of Biology
College:	Faculty of Applied Science
Institution:	UM AL – QURA UNIVERSITY
Revision Date	November 2019

A. Course Identification

1. Credit hours: **4 hours**	
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ■ Elective ☐	
3. Level/year at which this course is offered: 1st Year / Level 2	
4. Pre-requisites for this course (if any):	
5. Co-requisites for this course (if any):	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	70 %
2	Blended		-
3	E-learning		-
4	Correspondence		-
5	Other	30	30 %

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	42
2	**Laboratory/Studio**	42
3	**Tutorial**	-
4	Practical/Field work/Internship	6
5	**Others** (specify)	30
	Total	102
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	8
3	**Library**	15
4	**Projects/Research Essays/Theses**	10
5	**Others** (specify)	-
	Total	63

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover the principle of eukaryotic cell structure and function. This course will provide a conceptual and experimental background in biology sufficient to enable students to take courses that are more advanced in related fields

2. Course Main Objective

After completing this course student should be able to:

- Define the principles and concepts of the living cells.
- Differentiate between animal and plant cells
- Aware of the protoplasmic and non-protoplasmic cell contents and its structure and function.
- Study the different types of animal and plants tissues (structure and function).
- Understand the biological activities of the living cells.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
	Upon successful completion of this course The student will be able to: • Student will be familiar with the general characters of plant cells. • Student will be aware with the differences between plant and animal cells. • Student will be familiar with protoplasmic and non protoplasmic contents of plant cell. • Student will be familiar with the different types of plant tissues, their functions and distribution within plant body. • Define the difference between prokaryotic and eukaryotic cells. • Describe the fine structure and functions of all living organelles. • Explain biological activities of the animal cells. • Detect the difference between animal tissues. • Explain the function of animal tissues. • Discuss the distribution of all animal tissues in the body organs.	
2	**Skills:**	
2.1	**Cognitive skills to be developed** Having successfully completed the course students should be able to: • Explain the structure and function of the plant and animal cells. • Understand the ultrastructure and function of living organelles.	

	CLOs	Aligned-PLOs
	• Follow some of the biological activities of the cell. • List types of plant and animal tissues. • Differentiate between plant and animal tissues. • Explain specific characters of each tissues. • Classify the plants and animal tissues • The student will be able to detect the plant and animal tissues in selected organs examined under the microscopic.	
2.4.	**Psychomotor Skills** Upon successful completion of this course, the student is expected to be able to: • Practice the basic Lab. Skills. • Use light microscope in accuracy. • Prepare microscopic slides.	
3	**Competence:**	
3.1	Upon successful completion of this course, the student is expected to be able to: • Describe the structure of the cell • Explain most of the biological activities of the cell • Make short presentation about the cell and the animal tissues. • Defined the desirable sections. • Enhancing the ability of students to use computers and internet. • Interpret biological data • Present biological data orally. • Communicating personal ideas and thoughts. • Work independently and as part of a team to finish some assignments. • Communicate results of work to others. • Demonstrate professional attitudes and behaviors towards others. • Propose the smart questions • Understand and dissecting the problem so that it is fully solved understood. • Demonstrate the assertiveness for his decision. • Demonstrate his capability for the responsibility and Accountability • Show Effective verbal communication with clarity and must be characterize with the following interpersonal attributes; (verbal communication, non-verbal communication, good listening for the others, questioning, good manners, problem solving, social awareness, self-management, responsibility and accountability) . • Enhancing the ability of students to use computers and internet. • Interpret the laboratory data.	

CLOs		Aligned-PLOs
	• Know how to write a report.	

C. Course Content

1 Topics to be Covered		
Topic	No of Weeks	Contact hours
❖ **Introduction:** - The living cells. - Basis of cytology and histology. -Major differences between Eukaryotic and Prokaryotic cells. -Major differences between plant and animal cells	**1**	**3**
❖ **Plant cell morphology and structure I** - Cell wall, middle lamella, types of pits. - Structure and function. - Cytoplasmic ultra structure and function: Endoplasmic reticulum; mitochondria; Golgi apparatus, ribosomes	**1**	**3**
❖ **Plant cell morphology and structure II** - Plastids, chloroplasts, chromoplast, leucoplast types, morphology, ultra structure and function, distribution. -Non protoplasmic contents of plant cell (cell vacuole – carbohydrates – proteins – fats and oils – crystals glycosides – latex – alkaloids – tannins – organic acids) .	**1**	**3**

❖ **Animal cell morphology and structure I** -Fine structure of the Cell membrane and Cell junctions -Functions of cell membrane (cell transport) -Mitochondria, Peroxisomes, Lysosomes (phagocytosis, autocytosis and pinocytosis Centrioles, cytoskeleton, microtubules and microfilaments,	1	3
❖ **Animal / Plant cell morphology and structure: The Nucleus** -Nucleus, nuclear envelope, nucleopores, nucleoplasm, chromatin and nucleolus. Mitochondria, Golgi apparatus and functions of each organell.	1	3
❖ **Plant morphology and anatomy** -Meristematic tissues in plants – classification of meristematic tissues – Apical and lateral meristems- Permanent tissues. Dermal system, ground system and vascular system. Ground system; parenchyma cell, collenchyma cell and sclerenchyma cell. Seed germination, conditions necessary for seed germination, dicotyledonous seeds and seedling 1) broad bean (*Vicia faba*), kidney bean (*Phaseolus vulgaris*), monocotyledonous seeds and seedling 1) maize (*Zea mays*)	1	3
❖ **Plant morphology** Morphology of the root – functions of the root, zones of the root, types of the roots, Adventitious roots	1	3
Plant morphology ❖ Morphology of the stem- functions of the stem- origin, functions and types of the buds- Stem branching- habit of the stem- Metamorphosis of the stem.	1	3
❖ **Plant morphology** Morphology of the leaf- functions of the leaf- parts of the leaf- Arrangement of the leaf- types of the leaf- leaf venation- leaf metamorphosis		
❖ **Animal Histology I** -Introduction to Animal tissues difference and distribution of the animal tissues in the human body -Epithelial tissues, simple and stratified epithelia, glandular epithelia	1	3
❖ **Animal Histology II** -Connective tissues : Types of Cartilages Types of Bones Blood components	1	3

❖ **Animal Histology III** -Muscular tissues: -Smooth – skeletal – cardiac muscles. -Nervous tissues: -Neuron and its types - Nerve fibres - Neuroglial cells.	**1**	**3**
	14 weeks	**42hrs**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Upon successful completion of this course The student will be able to: • Student will be familiar with the general characters of plant cells. • Student will be aware with the differences between plant and animal cells. • Student will be familiar with protoplasmic and non protoplasmic contents of plant cell. • Student will be familiar with the different types of plant tissues, their functions and distribution within plant body. • Define the difference between prokaryotic and eukaryotic cells. • Describe the fine structure and functions of all living organelles. • Explain biological activities of the animal cells. • Detect the difference between animal tissues. • Explain the function of animal tissues. • Discuss the distribution of all animal tissues in the body organs	- The methodology includes a combination of lectures by the lecturer, seminar presentation by the students and web-interactions. - At the end of the programme, students will be divided into groups for seminar presentation on important areas of the course to assess their understanding and comprehension of the course. - All students will be involved in on-line learning process and each student is required to create an E-mail address to facilitate student web interactions. - Using images and movies - Encouraging students to collect the new	- Periodical exam and reports 10% - Mid- term theoretical exam 20% - Mid-term practical exam 5% - Final practical exam 15% - Final exam 40%

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		information about what the new in Microbiology Enable the reference books and scientific sites concerning General biology in internet.	
2.0	**Skills**		
2.1	**Cognitive skills** Having successfully completed the course students should be able to: • Explain the structure and function of the plant and animal cells. • Understand the ultrastructure and function of living organelles. • Follow some of the biological activities of the cell. • List types of plant and animal tissues. • Differentiate between plant and animal tissues. • Explain specific characters of each tissues. • Classify the plants and animal tissues • The student will be able to detect the plant and animal tissues in selected organs examined under the microscopic.	- Lectures -Brain storming -Discussion	- Exam must contain questions that can measure these skills. - Discussions after the lecture. - Quiz and exams
2.2	**Psychomotor Skills** Upon successful completion of this course, the student is expected to be able to: • Practice the basic Lab. Skills. • Use light microscope in accuracy. • Prepare microscopic slides.	- Follow up students the students in lab and during carryout all the laboratory experiments	-Giving additional marks for the students they have accurate laboratory results and good seminar presentation -Practical exam.
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	• Describe the structure of the cell • Explain most of the biological activities of the cell • Make short presentation about the cell and the animal tissues. • Defined the desirable sections. • Enhancing the ability of students to use computers and internet. • Interpret biological data • Present biological data orally. • Communicating personal ideas and thoughts. • Work independently and as part of a team to finish some assignments. • Communicate results of work to others. • Demonstrate professional attitudes and behaviors towards others. • Propose the smart questions • Understand and dissecting the problem so that it is fully solved understood. • Demonstrate the assertiveness for his decision. • Demonstrate his capability for the responsibility and Accountability • Show Effective verbal communication with clarity and must be characterize with the following interpersonal attributes; (verbal communication, non-verbal communication, good listening for the others, questioning, good manners, problem solving, social awareness, self-management, responsibility and accountability) . • Enhancing the ability of students to use computers and internet. • Interpret the laboratory data. • Know how to write a report.	- Lab work - Case Study - Active learning - Small group discussion - Homework (preparing a report on some topics related to the course depending on web sites). -Seminars presentation -Practical during carryout the experiments in the lab. -Field visiting for water and sewage-water treatment companies	- Oral exams. - Evaluate the efforts of each student in preparing the report. -Evaluate the scientific values of reports. - Evaluate the work in team - Evaluation of the role of each student in lab group assignment - Evaluation of students presentations

2. Assessment Tasks for Students

5. Schedule of Assessment Tasks for Students During the Semester

Assess ment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Exam duration	Proportion of Final Assessment
1	Periodical Exam (s)	4	15 min	10 %
2	Mid Term Exam (Theoretic)	8	60 min	20 %
3	Mid Term Exam (practical)	9	30 min	10 %
4	Reports and essay	11	--	5 %
5	Final Practical Exam	15	60 min	15 %
6	Final Exam	16	120 min	40 %
Total Marks				100%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Office hours: 10hrs.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Reece et. al (2013) Campbell Biology 10th edition. Benjamin Cunnings. Mauseth, J. (2008) Plant Anatomy. Blackburn Press Wojciech Paulina (2015) Histology: a text and atlas. LWW
Essential References Materials	
Electronic Materials	
Other Learning Materials	• **PPT prepared by Biology (plant and zoology) staff members.**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Class room is already provided with data show • The area of class room is suitable concerning the number of enrolled students (68) and air conditioned
Technology Resources	• Digital lab containing 15 computers.

Item	Resources
(AV, data show, Smart Board, software, etc.)	
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Incubators, autoclaves, measuring equipment, water bath, digital balances, pH meters, safety facilities. • Different media • All chemicals and reagents that needed • Availability all slides of plant and animal organs •

G. Course Quality Evaluation

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching • Questionaries • Open discussion in the class room at the end of the lectures.
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3. Processes for Improvement of Teaching • Preparing the course as PPT. • Using scientific movies. • Coupling the theoretical part with laboratory part • Periodical revision of course content.
4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution) • After the agreement of Department and Faculty administrations
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. • Periodical revision by Quality Assurance Units in the Department and institution

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Prepared by faculty staff: **1.Botany / Zoology academic staff members.**	**Signature:**
Date Report Completed: 1.11.2019	
Revised by: **1. Dr. Khaled Elbanna.** **2. Dr. Hussein H. Abulreesh.**	**Signature:**
Date: 1.11.2019	
Program Chair	**Signature:**

Dr. Hussein H. Abulreesh.	
Dean	Signature:
Date:	

Level Three

Fundamentals of Medical Physics 4032280-4

Differentiation and integration (2) 4042501-4

Cell Biology 4012312-2

General Physics (2) 4032102-4

Electricity and Magnetism 4032121-4

COURSE SPECIFICATION

Course Title:	**Fundamentals of Medical Physics**
Course Code:	**4032280-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Science**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4 Hrs	
2. Course type	
a. University ☐ College ☐ Department ☑ √ Others ☐	
b. Required √ Elective ☐	
3. Level/year at which this course is offered: Level 3 / 2nd year	
4. Pre-requisites for this course (if any)**: 4031101-4**	
5. Co-requisites for this course (if any)**:**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	40+39=79	90.8%
2	Blended	8	9.2%
3	E-learning	-	-
4	Correspondence	-	-
5	Other	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	**Laboratory/Studio**	42
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	89
Other Learning Hours		
1	**Study** (Private study including the laboratory hours)	110
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	20
3	**Library**	20
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2
	Total	157

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover the principle of physics, such as measurements, work and energy, Newton's laws, heat, fluid mechanics, and light. This course will provide a conceptual and experimental background in physics sufficient to enable students to take courses that are more advanced in related fields.

2. Course Main Objective

This course is designed to demonstrate the study of;

1- The motions of the living bodies as: static forces, friction, translational motion, angular motion,
2- Define elasticity and strength of materials.
3- Discuss the fundamentals of heat and life, kinetic theory and thermodynamics.
4- Describe different types of waves, sound, electricity, electrical technology.
5- Identify forces on bones and muscles, electrodynamics of nerve impulses, electrocardiograms, electro cardiogram and electroencephalogram.
6- Describe different biological effects in magnetic resonance and ultra-low frequency electromagnetic radiation, radiation therapy, imaging. and laser applications.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Recognize facts, principle and concepts of elementary medical Physics	K1, K5
1.2	Describe concepts, Procedures of some experiments in medical physics	K2,K6
2	**Skills:**	
2.1	Apply the laws of medical physics.	S1
2.2	Solve problems in Physics by using suitable mathematical principles	S2
2.3	Analyse and interpret quantitative results	S3
2.4	Express the medical physical phenomena mathematically.	S3
3	**Competence:**	
3.1	Work effectively in groups and exercise leadership when appropriate	C4
3.2	Collect and classify the material for a course	C2
3.3	Communicate effectively in oral and written form	C6,C2
3...		

C. Course Content

No	List of Topics	Contact Hours
1	**Static force** 1 Equilibrium and Stability 2 Equilibrium Considerations for the Human Body 3 Stability of the Human Body under the Action of an External Force 4 Skeletal Muscles 5 Levers 6 The Elbow 7 Friction Standing at an Incline	6
2	**Elasticity and Strength of Materials** 1 Longitudinal Stretch and Compression 2 A Spring 3 Bone Fracture: Energy Considerations 4 Impulsive Forces 5 Fracture Due to a Fall: Impulsive Force Considerations 6 Airbags: Inflating Collision Protection Devices 7-Whiplash Injury 8 Falling from Great Height 9 Osteoarthritis and Exercise.	6
3	**Wavs and Sound** 1 Properties of Sound 2 Some Properties of Waves (Reflection, Refraction, Interference, Diffraction) 3 Hearing and the Ear (Performance, Frequency and Intensity and Loudness) 4 Bats and Echoes 5 Sounds Produced by Animals 6 Acoustic Traps 7 Clinical Uses of Sound 8 Ultrasonic Waves Exercises	6
4	**Electricity** 1 The Nervous System 2 The Neuron 3 Electrical Potentials in the Axon 4 Action Potential 5 Axon as an Electric Cable 6 Propagation of the Action Potential 7 Synaptic Transmission .8 Action Potentials in Muscles 9 Surface Potentials	6

	10 Electricity in Plants 11 Electricity in the Bone	
4	**Optics** 1 Vision. 2 Nature of Light 3 Structure of the Eye 4 Accommodation 5 Eye and the Camera 6 Lens System of the Eye 7 Reduced Eye .8 Retina 9 Resolving Power of the Eye. 10 Threshold of Vision 11 Vision and the Nervous System. 12 Defects in Vision. 13 Lens for Myopia. 14 Lens for Presbyopia and Hyperopia 15 Fiber Optics	3
5	**Atomic Physics** 1 The Atom 2 Spectroscopy 3 Quantum 4 Electron Microscope 5 X-rays 6 X-ray Computerized Tomography 7 Lasers 7.1 Lasers application in medicine Exercises	6
6	**Nuclear Physics** 1 The Nucleus 3 Radiation Therapy 4 Food Preservation by Radiation 5 Isotopic Tracers 6 Laws of Physics and Life Exercises **Exercises and Solved problems**	3
7	**Nanotechnology in Biology and Medicine** 1 Nanostructures 2 Nanotechnology 3 Some Properties of Nanostructures 4 Medical Applications of Nanotechnology 5 Concerns Over Use of Nanoparticles in Consumer Products Exercises	3

8	**Heat and Life** 1 Energy Requirements of People 2 Energy from Food 3 Regulation of Body Temperature 4 Control of Skin Temperature 5 Convection 6 Radiation 7 Radiative Heating by the Sun 8 Evaporation 9 Resistance to Cold 10 Heat and Soil Exercises	3
Total		45 hrs

Practical part:

- The Human arm model--1
- The Human arm model--2
- Fluids Motion (1)
- Fluid motion (2)
- Doppler effect (Simulation)
- Determination of Ultrasound velocity in solids
- Determination of heart beats using electrocardiography
- Action potential (Simulation)
- Eye vision (1)
- Eye Vision model (2)
- X-ray
- Radioactive Dating (Simulation)

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize facts, principle and concepts of elementary medical Physics	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point	Solve some example, during the lecture. Exams: a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final)

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	d) Oral exams Discussions during the lectures.
1.2	Describe concepts, Procedures of some experiments in medical physics	1. Demonstrating the basic principle of the experiment. 2. Show the best ways to perform the experiments 3. Show the best ways to demonstrate the results. 4. Show the best way to write the reports about the experiment. 5. Discussion with the student about the results.	Home work. Writing scientific Reports. Doing team research or team project. Doing team work to perform some experiments Discussions during the class.
2.0	**Skills**		
2.1	Apply the laws of medical physics.	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem	1.Midterm's exam. Exams, short quizzes 2.Asking about physical laws previously taught 3.Writing reports on selected parts of the course 4.Discussions of how to simplify or analyze some phenomena
2.2	Solve problems in Physics by using suitable mathematical principles		
2.3	Analyse and interpret quantitative results		
2.4	Express the medical physical phenomena mathematically.		
3.0	**Competence**		
3.1	Communicate effectively in oral and written form	- Homework - preparing a report on some topics related to the course depending on web sites.	- Evaluation of presentations - Evaluation of reports - - Practical exam - Homework - Final exams.
3.2	Collect and classify the material for a course		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.3	Work effectively in groups and exercise leadership when appropriate.	- Lab work. - Small group discussion. - Develop their interest in Science through :(lab work, field trips, visits to scientific and research.	- Evaluate the work in team. - Evaluation of the role of each student in lab group assignment □□Evaluation of student presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	7 &14	20 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	11	10 %
5	Final Practical Exam	15	10%
6	Final Exam (Written Test)	16	50 %
7			
8			

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will supervise by an academic adviser in physics Department and the time table for academic advice were given to the student each semester. (2 hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1-Paul Davidovits "Physics in Biology and Medicine" 3rd edi. Elsevier 2008. 2-Russell K. Hobbie & Bradley J. Roth "Intermediate Physics for Medicine and Biology" Springer Science 2007
Essential References Materials	Raymond A. Serway - John W. Jewett "Physics for Scientists and Engineers" 2004. John R. Cameron & James G. Skofronick "Medical physics" Willy John 1988

	Physics, 4th edition , By: Halliday, Resnick, and Krane, Wiley (1992) Physics , 4th edition, By: J. Walker (2010)
Electronic Materials	https://phet.colorado.edu/ https://www.iea.org/
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board. There are enough laboratories for experimental physics, provided with air conditions, good data show, and experimental equipment.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students – program leader – quality&development unit – assessment & evalution committee – peer-reviewers	Direct & indirect
Extent of achievement of course learning outcomes	Curriculum committee – assessment & evaluation committee – quality & development committee – peer-reviewers	indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	

Date	

COURSE SPECIFICATION

Course Title:	**Calculus (2)**
Course Code:	**30112501-4**
Program:	**B. Sc. Medical Physics**
Department:	**Mathematical Science**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	4 hours
2. Course type	
a. University ☐ College ☐ Department ■ Others ☐	
b. Required ■ Elective ☐	
3. Level/year at which this course is offered:	3rd Level / Second Year
4. Pre-requisites for this course (if any)**:**	Calculus (30111101-4)
5. Co-requisites for this course (if any)**:**	None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4 hours per week	100%
2	Blended		0%
3	E-learning		0%
4	Correspondence		0%
5	Other		0%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	(4 hours) x (15 weeks)
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	60 hours
Other Learning Hours*		
1	Study	(1 hour) x (15 weeks)
2	Assignments	(1 hour) x (15 weeks)
3	Library	(1 hour) x (15 weeks)
4	Projects/Research Essays/Theses	0
5	Others (specify)	0
	Total	45 hours

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Calculus is the first of the required courses in the mathematics program. This course provides a unique introduction to a course in single-variable calculus. Key topics of the course include exponential, logarithmic, inverse trigonometric functions, integral evaluation, improper integrals, area of the plane region, area between two curves, volumes by slicing, disk and washers, volumes by cylindrical shells.

2. Course Main Objective

The primary objective of the course is to introduce students to the concepts of calculus and to develop the student's confidence and skill in dealing with mathematical expressions. Students will see that there is an important connection between the derivative of a function and the derivative of its inverse. In addition students will recognize systematic procedure from attacking unfamiliar integrals. Among the objectives we can cite the understanding of the role of definite integrals in the calculation of volumes and surfaces of solids.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Recall the relation between the derivative of a function and the derivative of its inverse	
1.2	State basic properties of exponential and logarithmic functions	
1.3	Recognize principles of integral evaluation	
1.4	Present definite integral as the limit of Riemann sums	
2	**Skills :**	
2.1	Express logarithmic forms of inverse hyperbolic functions	
2.2	Distinguish methods for approaching integration problems	
2.3	Calculate integrals over infinite intervals	
2.4	Apply the definite integral in geometry and engineering	
3	**Competence:**	
3.1	Develop connections of calculus with other disciplines.	
3.2	Solve problems using a range of formats and approaches in basic science.	
3.3	Show the ability to work independently and within groups.	

C. Course Content

No	List of Topics	Contact Hours
1	**Exponential, Logarithmic and inverse trigonometric functions** • Exponential and Logarithmic functions	20

	• Derivatives and Integrals involving Inverse Trigonometric functions • Hyperbolic functions	
2	**Principal of Integral Evaluation** • An overview of integration methods • Integration by parts • Trigonometric integrals • Trigonometric substitutions • Integrating rational functions by partial fractions	16
3	**Improper integrals**	12
4	**Applications of the definite integral** • Area between two curves • Volumes by Slicing, Disks and Washers • Volumes by Cylindrical Shells • Length of a plane curve • Area of a surface of revolution	12
	Total	60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recall the relation between the derivative of a function and the derivative of its inverse	Lectures Problem Solving Memorization Lectures, tutorials and internet	Exams Homework assignments Quizzes Periodic exams and final exam
1.2	State basic properties of exponential and logarithmic functions		
1.3	Recognize principles of integral evaluation		
1.4	Present definite integral as the limit of Riemann sums		
2.0	**Skills**		
2.1	Express logarithmic forms of inverse hyperbolic functions	Lectures Solving Problems Small group work Lectures, tutorials and internet	Exams Quizzes Portfolios Periodic exams and final exam
2.2	Distinguish methods for approaching integration problems		
2.3	Calculate integrals over infinite intervals		
2.4	Apply the definite integral in geometry and engineering		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.0	**Competence**		
3.1	Develop connections of calculus with other disciplines.	Class discussions Small group work Research activities	Reports Quizzes Discussion
3.2	Solve problems using a range of formats and approaches in basic science.		
3.3	Show the ability to work independently and within groups.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Test (1)	7^{th} week	20%
2	Midterm Test (2)	12^{th} week	20%
3	Homework + Reports +Quizzes	During the semester	10%
4	Final Examination	End of semester	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1- Office hours per week in the lecturer schedule (4 hrs\week).

2- Contact with students by e-mail, and e-learning facilities.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Calculus (Ninth Edition)by Dale Varberg, Edwin Purcell and Steven Rigdon, chapters 4-8
Essential References Materials	Calculus (Ninth Edition)by Dale Varberg, Edwin Purcell and Steven Rigdon
Electronic Materials	http://en.wikipedia.org/wiki/Calculus

Other Learning Materials	Maple

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom with capacity of 25-students. Library
Technology Resources (AV, data show, Smart Board, software, etc.)	Data Show, Smart Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Direct
Quality of learning resources	Students	Direct
Extent of achievement of course learning outcomes	Faculty Member	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Council of the Mathematics Department
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	Cell Biology
Course Code:	4012312-2
Program:	Medical Physics
Department:	Physics
College:	Faculty of Applied Science
Institution:	Um Al-Qura University

Table of Contents

A. Course Identification

1. Credit hours:	**3 hours.**
2. Course type a. University ☐ College ☐ Department ☑ Others ☐ b. Required ☑ Elective ☐	
3. Level/year at which this course is offered:	**2rd Year / Level 3**
4. Pre-requisites for this course (if any):	**General Biology (4011101-4)**
5. Co-requisites for this course (if any):	**NA.**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	50
2	Blended	-	-
3	E-learning	-	-
4	Correspondence	-	-
5	Other	30	50

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	30
2	Laboratory/Studio	42
3	Tutorial	-
4	Others (specify)	30
	Total	102
Other Learning Hours*		
1	Study	30
2	Assignments	8
3	Library	15
4	Projects/Research Essays/Theses	10
5	Others (specify)	-
	Total	63

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Biology of cells: This course focus on the study of the structure and function and biosynthesis of cellular membranes and organelles of the Eukaryotic cell. We will cover the following main topics: chemical, ultrastructure and composition of cell membrane, cell transport, receptors, trafficking and cell signaling; cell growth and oncogenic transformation; the role of cytoskeleton in cell movement; the breakdown of macromolecules; generation of cell energy; and the integration of cells into tissues. We will also cover important cellular processes such as cell cycle regulation, signal transduction, programmed cell death (apoptosis), and cancer cell biology. Study the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure and RNA synthesis. Likewise, we will attempt to relate defects in these various cellular processes to cell diseases to help gain a better understanding for what happens when cells don't work as they should.

2. Course Main Objective

After completing this course, students should be able to:

- **Describe the fundamental principles of cellular biology.**
- **Apply these principals to current biological questions of today.**
- **Develop a deeper understanding of cell structure and how it relates to cell functions.**
- **Understand cell movement and how it is accomplished; how cells grow, divide, and die and how these important processes are regulated.**
- **Comprehend mechanism of programming cell death (apoptosis).**
- **Recognize cell signaling and how it regulates cellular functions.**
- **Know dis-regulation leads to cancer and cell diseases in order to better understanding for what happens when cells don't work as they should.**
- **Identify the cellular processes: cell transport, and trafficking; the role of cytoskeleton in cell movement; the breakdown of macromolecules; generation of cell energy; and the integration of cells into tissues.**
- **Apply practical and experimental applications concerned with cell biology.**
- **Submit oral presentation about selected cellular processes.**

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	**Identify and describe the structure and function of eukaryotic animal or human cells**	
1.2	**Learn the principles of cell biology**	
1.3	**Know main cellular activities such as: cell growth; cell cycle; cell signaling.**	
1.4	**Understand cell signaling and how it regulates cellular functions.**	
1.5	**Assimilate**	
1.6	**Recognize the neural connections, innervation at organ level.**	
1.7	**Realize mechanisms of generation of cell energy.**	

CLOs		Aligned-PLOs
1.8	Acquire intracellular movements, transportation and protein synthesis; biosynthesis of cellular membranes and organelles; cell growth and oncogenic transformation; transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure and RNA synthesis.	
2	**Skills:**	
2.1	Summarize the structure and function of cell activities.	
2.2	Distinguish intracellular movements, transportation; the cytoskeleton, the extracellular matrix, and cell movements;.	
2.3	Describe chromatin structure and RNA synthesis	
2.4	Define biosynthesis of cellular membranes and organelles	
2.5	Explain biosynthesis, transport, receptors, cell signaling, cell growth and oncogenic transformation.	
2…	Apply / measure some practical physiological applications.	
3	**Competence:**	
3.1	Developing oral presentations and leader ship activity	
3.2	Communicating personal ideas and thoughts	
3.3	Work independently, Self-learning and as part of a team,	
3.4	To examine, describe, draw, dissect or contribute reports.	

C. Course Content

No	List of Topics (16 weeks)	Contact Hours
1	Introduction, what is and what is not cell biology, properties and behaviors of cells; Structure of biological membranes, lipids and lipid modification, membrane proteins; the microtubule cytoskeleton. Revision: on biomolecule metabolism (Carbohydrate, Fatty acid amino acids metabolisms).	2
2	The extracellular matrix; plasma membrane; pumps, channels, transporters; Receptors, basics of signal transduction. Student activities (seminar): The osmosis and diffusion and facilitated and active diffusions and how they occurred and their importance inside the cells	2
3	Protein synthesis (transcription and translation), biogenesis of membrane proteins. Student activities (seminar): Chloroplasts and their different structures and how photosynthesis occurs inside plant cells	2
4	DNA replication (Regulation of DNA synthesis)	2
5	Cell cycle checkpoints; regulation of the cell division cycle; (mitosis and Meiosis).	2
6	Midterm Exam	2
7	Protein modifications and intracellular transport, glycosylation, vesicular transport, receptor mediated endocytosis, lysosomes, organelle biogenesis.	2

8	Protein modifications and intracellular transport II	2
9	Signal transduction: Detailed molecular mechanisms	2
10	Nerve cells, ion channels, synapse, Ca++ regulated events	2
11	Immunity and host pathogen interactions	2
12	The actin-myosin cytoskeleton	2
13	Cancer	2
14	Stem cells and cloning	2
15	Revision	2
16	Final exam.	
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Identify and describe the structure and function of eukaryotic animal or human cells	Study the principles of cell of cell biology. Study mechanism of touch, olfaction, vision, and hearing. Lectures and student research papers; visual display "PowerPoint"; Homework assignments; Discussions; Handout of lecture notes	Homework; Quizzes; oral, presentation evaluation, sheet, discussion, midterm and final exams.
1.2	Learn the principles of cell biology		
1.3	Know main cellular activities such as: cell growth; cell cycle; cell signaling.		
1.4	Understand cell signaling and how it regulates cellular functions.		
1.5	Assimilate		
1.6	Recognize the neural connections, innervation at organ level.		
1.7	Realize mechanisms of generation of cell energy.		
1.8	Acquire intracellular movements, transportation and protein synthesis; biosynthesis of cellular membranes and organelles; cell growth and oncogenic transformation; transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure and RNA synthesis.		
2.0	Skills		
2.1	Summarize the biosynthesis of cellular membranes and organelles. And apply the concerned practical activities,	1. Interactive lectures. 2. Seminars. 3. Participation of students in	- Exam must contain questions that can measure these skills.
2.2	Categorize cell movements; transportation; protein synthesis.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	Apply lab applications. Submit individual or team reports	discussions during the lecture. 4. Trying to explain the issues in regular and motivated manner. Follow up the students in lab and during carryout all analytical techniques.	- Quiz and exams. - Discussions after the lecture. Practical exam.
2.4	Develop critical thinking skills to summarize the cell growth and oncogenic transformation; transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure and RNA synthesis.		
2.5	Relate and realize the cell growth and oncogenic transformation; transport, receptors, and cell signaling; the cytoskeleton, the extracellular matrix, and cell movements; chromatin structure and RNA synthesis.		
2.6	Differentiate between intracellular movements, transportation and protein synthesis; biosynthesis of cellular membranes and organelles.		
2.7	Précis how the cell regulates biosynthesis; cell cycle; cell signaling; DNA replication.		
2.8	Dealing, safely, with lab activities and modern laboratory equipment to conduct practical physiological applications.		
3.0	Competence		
3.1	Personal leader ship activity	Follow up, correction, reorientation of their work. Discussion	Evaluation, oral exam, written exam
3.2	Teamwork activity		
…	Reports and presentations		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical Exam(s)	4	10 %
2	Mid Term Exam (Theoretic)	8	20 %
3	Mid Term Exam (practical)	9	10 %
4	Reports and essay	11	5 %
5	Final Practical Exam	15	15 %
6	Final Exam	16	40 %
	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice: **2 Office hours/week**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**G. biology; Cell Biology, Biochemstry.**
Essential References Materials	**Text Books of cell structures and functions**
Electronic Materials	**http:// www.kenan online.com** **http:// www.Sehhal.com** **http:// www.Allbiologz.com**
Other Learning Materials	**CD prepared by the staff members containing U-tube videos.** **Multi- media associated with the text book and the relevant websites.** **Biological charts, U-tubes and video**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**The areas of class rooms are suitable, concerning the number of enrolled students; and air conditioned.** **Lecture room equipped with a black board and Data show. Instructors use their own laptop.** **Physiology lab well equipped.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**Class rooms are already provided with data show, audio-visual equipment.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**Laboratory instruments & equipment: Cooling centrifuge, pH meters, flasks, beakers, screw capped tubes, slides and tips and chemicals kits.**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students.	Class room discussions. Questionnaires.
Evaluation of Teaching	Instructor or by the Department	Revision of student answer paper by another staff member. Analysis the grades of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Prof. Dr. Hamid Mutwally; Prof. Osama Mohamed Sarhan; Dr. Zuhair Alsahhaf; Dr Azzam Alyakoob.
Reference No.	
Date	21/11/2019

COURSE SPECIFICATION

Course Title:	**General Physics 2**
Course Code:	**4032102-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm AL-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. Level/year at which this course is offered: **2nd Year / Level 2**	
4. Pre-requisites for this course (if any)**: General physics 4031101-4**	
5. Co-requisites for this course (if any)**: ---**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	42
3	Tutorial	
4	Exams and Quizzes	8
	Total	95
Other Learning Hours*		
1	Study	60
2	Assignments	15
3	Library	
4	Exams and Quizzes	20
5	Laboratory	20
	Total	115

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The main purpose of the course to covering some advanced physics principle in mechanics, such as particle dynamics, system of particles, collisions, rotational kinematics, rotational dynamics, oscillations, etc. This course will provide a conceptual and experimental background in physics sufficient to enable students to take courses that are more advanced in related fields.

2. Course Main Objective

1- From using the E-learning web based in the university web site, the students improve their IT skill
2- Outlines of the physical laws, principles and the associated proofs.
3- Highlighting the day life applications whenever exist.
4- Encourage the students to see more details in the international web sites and reference books in the library.
5- Encourage the student to build an example of different experiments related to course

Frequently check for the latest discovery in science

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**On successful completion of this course it is expected that students will be able to:	
1.1	Recognize facts, principle and concepts of elementary Physics 1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it	K1, I
1.2	1. Demonstrating the basic principle of the experiment. 2. Show the best ways to perform the experiments 3. Show the best ways to demonstrate the results. 4. Show the best way to write the reports about the experiment. 5. Discussion with the student about the results.	K3, I
2	**Skills:**	
2.1	Apply the laws of physics • Preparing main outlines for teaching • .Following some proofs	S1, P
2.2	Solve problems in Physics by using suitable mathematical principles	S1, P

	CLOs	Aligned PLOs
	• Ask the student to attend lectures for practice solving problem • Encourage the student to look for the information in different references	
2.3	Analyse and interpret quantitative results • Preparing main outlines for teaching • Following some proofs • Define duties for each chapter	S1, P
2.4	Express the physical phenomena mathematically • Following some proofs • Define duties for each chapter • Encourage the student to look for the information in different references • Ask the student to attend lectures for practice solving problem	S2, I
3	**Competence:** On successful completion of this course it is expected that students will be able to:	
3.1	Show responsibility for self-learning to be aware with recent developments in physics • Search through the internet and use the library. • Lab work. • Small group discussion. • Enhance educational skills.	C1, I
3.2	Work effectively in groups and exercise leadership when appropriate. • Develop their interest in Science through :(lab work, field trips, visits to scientific and research. • Encourage the student to attend lectures regularly Give students tasks of duties	C3, I

4. Program learning Outcomes*

Knowledge: Summary description of the knowledge to be acquired and on completing this program, students will be able to:

K1 Acquire the major aspects of nature and subject of medical physics and the application of physics to medicine.

K2 List matter in various forms, including crystals, semiconductors, atoms, nuclei and understand the principles of laser and its application in medicine.

K3 Recognize Bioinformatics in order to know how to analysis data which is used to diagnose with the aid of different medical devices such as X- ray machines, gamma camera, accelerator and nuclear magnetic resonance.

K4 Define different quantitative, mathematical science and physical tools analyze problems and list some foundations of systems theory to solve and analysis different problems.

K5 Recognize the nature, properties, dosimetery of radiation and basics of radiation protection and also medical effects of ionizing and non-ionizing radiation.
K6 Outline the principles of physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics.

Skills: ***Summary description of the skills to be acquired and on completing this program, students will be able to:***

S1 Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in medical physics and related fields of studies.
S2 Formulate and test hypotheses using appropriate experimental design and analysis of data (Computer simulation) and integrate IT-based solutions into the user environment effectively.
S3 Analyze and evaluate information by using computational tools to interpret experimental data relevant to medical physics by using packages from different theoretical and experimental resources, and perspectives.
S4 Operate some medical instruments such as that used for the diagnosis of different diseases in medical centers and demonstrate competency in laboratory techniques and safety.
S5 Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.
S6 Justify ethical, social and legal responsibilities concerning medical physics.

Competence: ***Summary description of the Competence to be acquired and on completing this program, students will be able to:***

C1 Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of medical physics issues.
C2 Demonstrate scientific concepts and analytical argument, in a clear and organized way, verbally and in writing.
C3 Implement all kinds of relevant information in medical physics through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.
C4 Work effectively in groups as well as individuals and appraise the cooperation through teamwork to assess and criticize various emergent problems.
C5 Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.
C6 Summarize, document, report, and reflect on own findings.

C. Course Content

No	List of Topics	Contact Hours
1	**Particle dynamics** 1- Force laws. 2- Frictional Forces. 3- The Dynamics of uniform Circular motion 4- Equation of motion: constant and non-constant forces. 5- Time-dependent forces; analytical methods 6- Time-dependent forces: numerical methods.	3

	7- Drag forces and the motion of projectiles.	
2	**Conservation of energy** 9- Conservative force. 10- Potential energy. 11- One dimensional conservative systems. 12- Two-and three-dimensional conservative systems. 13- Conservation of energy of a system of particles. 14- Mass and energy. 15- Quantization of energy.	3
3	**System of particles** 7- Two particle system 8- Many particle system 9- Centre of mass of solid objects 10- Linear momentum of system of particles. 11- Conservation of linear momentum 12- Work and energy in system of particles 13- Systems of variable mass.	3
4	**Collisions** 1- What is collisions? 2- Impulse and momentum. 3- Conservation of momentum during collision. 4- Collisions in one dimension. 5- Two dimensional collisions. 6- Center of mass reference frame. 7- Spontaneous decay process.	3
5	**Rotational Kinematics** 1- Rotational motion. 2- Rotation variables. 3- Rotation with constant angular acceleration. 4- Rotational quantities as vectors. 5- Relationship between linear and angular variables: scalar form. 6- Relationship between linear and angular variables: vector form.	4
6	**Rotational dynamics** 6. Rotational dynamics 7. Kinetic energy of rotation and rotational inertia. 8. Rotational inertia of solid bodies 9. Rotational dynamics of rigid body 10. Combined rotational and translational motion.	3
7	**Angular momentum**	3

	1- Angular momentum of a particle 2- System of particles 3- Angular momentum and angular velocity 4- Conservation of angular momentum 5- The spinning top. 6- Quantization of angular momentum.	
8	**Equilibrium of Rigid bodies** 1- Condition of equilibrium. 2- Center of Gravity. 3- Examples of equilibrium. 4- Stable, unstable, and Neutral equilibrium or rigid bodies in a gravitational field. 5- Elasticity.	3
9	**Oscillations.** 7. Oscillating systems. 8. The simple harmonic oscillator. 9. Simple harmonic motion 10. Energy considerations in simple harmonic motion. 11. Applications of simple harmonic motion 12. Simple harmonic motion and uniform circular motion. 13. Combinations of harmonic motions 14. Damped harmonic motions 15. Forced harmonic motions. .	4
10	**Gravitation** 7. Gravitation from the Ancients to Kepler. 8. Newton and the law of universal gravitation. 9. The gravitation constant G 10. Gravity near the Earth's surface. 11. Gravitational Effect of a spherical distribution of matter 12. Gravitational potential energy 13. The gravitational field and potentials 14. The motions of planets and satellites Universal gravitation. .	4
11	**Wave Motion** 6. Mechanical waves. 7. Types of waves. 8. Traveling waves. 9. Wave speed 10. The wave equation	3

	11. Power and intensity in wave motion 12. The principle of superposition 13. Interference of waves 14. Standing wave. 15. Resonance.	
12	**Sound Wave** 1. The speed of sound. 2. Traveling longitudinal waves. 3. Power and intensity of sound waves. 4. Standing longitudinal waves. 5. Vibrating systems and sources of sound. 6. Beats 7. The Doppler effect	3
13	**Solved problems**	6
	Total	**45hrs**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize facts, principle and concepts of elementary Physics	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	Solve some example during the lecture. Exams: a) Quizzes (E-learning) b) Short exams (mid-term exams) c) Long exams (final) d) Oral exams Discussions during the lectures.
1.2	Describe concepts, Procedures of some experiments in physics	Describe concepts, Procedures of some experiments in physics the reports about the experiment.. Discussion with the student about the results.	Home work. Writing scientific Reports. Doing team research or team project.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			Doing team work to perform some experiments Discussions during the class
…			
2.0	**Skills**		
2.1	Apply the laws of physics.	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem	1.Midterm's exam. Exams, short quizzes 2.Asking about physical laws previously taught 3.Writing reports on selected parts of the course 4.Discussions of how to simplify or analyze some phenomena
2.2	Solve problems in Physics by using suitable mathematical principles		
2.3	Analyse and interpret quantitative results		
2.4	Express the physical phenomena mathematically.		
3.0	**Competence**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	• Search through the internet and use the library. • Lab work. • Small group discussion. • Enhance educational skills. • Develop their interest in Science through :(lab work, field trips, visits to scientific and research. • Encourage the student to attend lectures regularly Give students tasks of duties	• Evaluate the efforts of each student in preparing the report. • Evaluate the scientific values of reports. • Evaluate the work in team • Evaluation of the role of each student in lab group assignment Evaluation of students presentations
3.2	Work effectively in groups and exercise leadership when appropriate.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Home works	All weeks	5 %
2	Scientific activities	All weeks	5 %
3	Midterm Exam (theoretical)	9^{th} week	20%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
4	Lab. Reports (Practical)	11th week	10%
5	Final Exam (Practical)	15th week	10%
6	Final Exam (theoretical)	16th week	50%
7	**Total**		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will supervise by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Physics, 4th edition , By: Halliday, Resnick, and Krane, Wiley (1992)
Essential References Materials	
Electronic Materials	https://phet.colorado.edu/en/simulations/category/physics www.uqu.sa/baewiss
Other Learning Materials	Physics , 4th edition, By: J. Walker (2010)

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board. There are enough laboratories for experimental physics, provided with air conditions, good data show, and experimental equipment.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board.

Item	Resources
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	Students Classroom Observation Committee Professional Development Unit External Reviewers such as the CEA Accreditation Agency	Student Surveys Formal Classroom Observation
Effectiveness of Assessment	Curriculum and Test Development Unit Curriculum Committee Assessment Committee External Reviewers such as the CEA Accreditation Agency	Item Analysis Data Teacher Feedback Student Feedback Course Reports
Extent of Achievement of Course Learning Outcomes	Quality Assurance Unit Curriculum and Test Development Unit	Item Analysis Data Course Reports Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Electricity and Magnetism**
Course Code:	**4032121-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm AL-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: **4hrs**	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☐ Elective ☐	
3. Level/year at which this course is offered: **2nd Year / Level 3**	
4. Pre-requisites for this course (if any)**: General physics 4031101– 4**	
5. Co-requisites for this course (if any)**:**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3	75%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other	3	25%

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45 Hours
2	Laboratory/Studio	42 Hours
3	Tutorial	
4	**Others** (specify) **Exams & quizzes**	8 Hours
	Total	95 Hours
Other Learning Hours*		
1	Study	60 Hours
2	Assignments	15 Hours
3	Library	20 Hours
4	Projects/Research Essays/Theses	
5	**Others** (specify) **Practical**	20 Hours
	Total	115 Hours

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description This course will provide a conceptual and experimental background in physics sufficient to enable students to take courses that are more advanced in related fields. It covers the followings: Electric charge, electric fields, superposition, Gauss' Law, surface integrals, electric flux, the electric potential, simple circuits, Ohm's Law, magnetic fields, Ampere's Law, electromagnetic induction, capacitors, inductors.
2. Course MainObjective 1. Provide and define the fundamental properties of the electric charge, solve technical problems associated with the electrostatic force (Coulomb force), 2. Identify that at every point in the space surrounding a charged particle, the particle sets up an electric field , which is a vector quantity and thus has both magnitude and direction. 3. Identify how an electric field can be used to explain how a charged particle can exert an electrostatic force on a second charged particle even though there is no contact between the particles. 4. Explain how a small positive test charge is used (in principle) to measure the electric field at any given point. 5. Define electric capacitance and solve technical problems associated with capacitors of various symmetries, capacitors in series and parallel combination, the microscopic effect of dielectric materials on capacitance and stored energy. 6. Define electric current, current density, and solve technical problems involving DC networks of resistors, batteries, and capacitors, Ohm's Law, Kirchhoff's laws, and RC charging and decay circuits. 7. Calculate the potential difference between any two points in a circuit. 8. Distinguish a real battery from an ideal battery and, in a circuit diagram, replace a real battery with an ideal battery and an explicitly shown resistance. 9. Calculate the net rate of energy transfer in a real battery for current in the direction of the emf and in the opposite direction. 10. Define the magnetic field and magnetic flux, solve technical problems associated with the effect of static, non-uniform and uniform magnetic fields on moving charges and current-carrying wires, loops and the magnetic dipole. 11. Calculate the magnitude and direction of the magnetic field for symmetric current distributions using the Law of Biot-Savart and Ampere's Law, and state the limitations of Ampere's Law. 12. State Faraday's Law of Induction with Lenz's Law and use these equations to solve technical problems associated with induction. 13. Calculate inductance according to the fundamental definition, solve technical problems associated with LR circuits and coils, and calculate the stored energy in

magnetic fields.

In addition to these items, the students should gain practical skills through performance some experimental class.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	**Knowledge:**	
1.1	Recognize most fundamental concepts of electric charge, electric current, and electric and magnetic fields.	K1+K2
1.2	Relate electric and magnetic fields to their sources.	K1+K2
1.3	Extract electric potential from electric field, and vice versa.	K1+K2
1.4	Learn students how charges and currents respond to electric and magnetic fields and also how charges and current generate electric and magnetic fields.	K1+K2
1.5	Investigate practical fundamentals of linear electric circuit components and how their operation is governed by the fundamental laws of electricity and magnetism.	K3
2	**Skills:**	
2.1	Applying physics concepts toward solving a broad range of problems – including conceptual and technical problems, both familiar and unfamiliar – with clarity, precision, logical coherence, and mathematical sophistication.	S1+S3
2.2	Capacity to explain problem-solving work correctly, clearly, and completely, further demonstrating the breadth and depth of their understanding.	S2+S3
2.3	Perform simple lab experiments.	S2
2...		
3	**Competence:**	
3.1	Relate theoretical scientific concepts to experimental results.	C1+C2
3.2	Show responsibility for how physics as a discipline can be used to obtain a deep understanding of how the world really works and how that knowledge can be used to make predictions and solve problems.	C1+C3
3.3	Demonstrate effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.	C1+C2
3.4	Work effectively both individually and in teams.	C1

C. Course Content

No	List of Topics	Contact Hours
1	**Electric charge and Coulomb's law:** Electric Charge, Conductors and Insulators, Coulomb's law, Charge is Quantized, Charge is Conserved, Sample problems.	**4**
2	**Electric Fields:** Charges and Forces, The Electric Field, Electric field lines, Electric Field Due to a Point Charge, Electric Dipole, Electric Field Due to Continuous Charge Distribution, A Point Charge in an Electric Field, A Dipole in an Electric Field, Sample problems.	**5**
3	**Gauss' Law:** Flux of an Electric Field, Gauss' Law, Gauss' Law and Coulomb's Law, Conductors in Equilibrium, Applying Gauss' Law: Cylindrical Symmetry, Applying Gauss' Law: Planar Symmetry, Applying Gauss' Law: spherical Symmetry.	**6**
4	**Electric potential:** Electric Potential Energy, Electric Potential, Equipotential surfaces, Calculating the potential from the field, Potential Due to a Point Charge, Potential Due to a group of Point Charges, Calculating the field from the potential, Electric Potential Energy of a System of Point Charges, Potential of a Charged Isolated Conductor.	**6**
	1st Periodic Exam	**1**
5	**Capacitors and Capacitance:** Capacitors, Capacitance, Calculating the Capacitance, Capacitors in Parallel and in Series, Energy Stored in an Electric Field, Capacitor with a Dielectric.	**4**
6	**Current and Resistance:** Electric Currents, Current density, Resistance and Resistivity, Ohm's Law, Power in Electric Circuits.	**5**
7	**DC Circuits:** Electromotive Force,Electric Power, Kirchhoff's Rules, Calculating the Current in a Single Loop, Potential Differences, Resistors in Series and Parallel, Multiloop Circuits, Charging and Discharging Capacitors, RC Circuits.	**5**
	2nd Periodic Exam	**1**
8	**Magnetic Field:** Sources of Magnetic Field, Magnetic Force on a Moving Charge, Circulating Charges, Hall Effect, Magnetic Force on a Current, Torque on a Current LoopThe Magnetic Force on a Current, The Magnetic Dipole.	**6**
9	**Ampere's Law:** Biot-Savart' Law, Applications of Biot-Savart Law, Lines of Magnetic Field, Ampere's Law, Solenoids and Toroids.	**6**
10	Note: The lab experiments are presented and taught separately (3 hrs./week). Below is the list of the experiments: 1. General introduction 2. Determining the capacitance of a capacitor.	**42**

	3. Capacitors in series and parallel 4. Verification of Ohm's law. 5. Resistors in series and parallel. 6. Determining the time constant of an RC circuit. 7. Kirchhoff's rules. 8. Electrical resistivity. 9. Magnetic force on a current-carrying wire 10. Biot-Savart law: Measuring the magnetic field for straight and circular conductors as a function of current. 11. Verification of the relationship between the magnetic field of a straight conductor and the distance from the conductor. 12. Magnetic field of a solenoid. 13. Review (2 weeks).	
	Lab Final Exam	**2**
	Final exam	**2**
	Total	**95**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Recognize most fundamental concepts of electric charge, electric current, and electric and magnetic fields.	**1.** Lectures. **2.** Discussions **3.** Slides and computer simulation software may be used by the teachers to clarify concepts. **4.** Problems solving	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question –answer session in class. **4-** Exams: quizzes, Mid-term and final exams
1.2	Relate electric and magnetic fields to their sources.		
1.3	Extract electric potential from electric field, and vice versa.		
1.4	Learn students how charges and currents respond to electric and magnetic fields and also how charges and current generate electric and magnetic fields.		
1.5	Investigate practical fundamentals of linear electric circuit components and how their operation is governed by the fundamental laws of electricity and magnetism.		
2.0	**Skills**		

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
2.1	Applying physics concepts toward solving a broad range of problems – including conceptual and technical problems, both familiar and unfamiliar – with clarity, precision, logical coherence, and mathematical sophistication.	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Ask the students to search the internet and use the library. **5.** Encourage them how to attend lectures regularly by assigning marks for attendance. **6.** Small group discussion. **7.** Give students tasks of duties.	**1-** Question –answer session in class. **2-** Exams: quizzes, Mid-term and final exams **3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours.
2.2	Capacity to explain problem-solving work correctly, clearly, and completely, further demonstrating the breadth and depth of their understanding.		
2.3	Perform simple lab experiments.	Lab work	**1.** Lab Reports **2.** Lab exam
3.0	**Competence**		
3.1	Relate theoretical scientific concepts to experimental results.	**1.** Lab work. **2.** Discussions.	**1.** Lab Reports **2.** Lab exam
3.2	Show responsibility for how physics as a discipline can be used to obtain a deep understanding of how the world really works and how that knowledge can be used to make predictions and solve problems.	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Ask the students to search the internet and use the library. **5.** Encourage them how to attend lectures regularly by assigning marks for attendance. **6.** Small group discussion. **7.** Give students tasks of duties.	**1-** Question –answer session in class. **2-** Exams: quizzes, Mid-term and final exams **3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours.
3.3	Demonstrate effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.		
3.4	Work effectively both individually and in teams.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homeworks & Participation in activities during lectures/or quizzes	All weeks	10%
2	Lab reports	All weeks	10%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	1st Periodic Exam	7th week	10%
4	2nd Periodic Exam	12th week	10%
5	Lab Final Exam	16th week	10%
6	Final exam	18th week	50%
7			
8			

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Besides discussions in class and lab, Students are supervised by academic advisors in physics Department. The time tables for academic advisors are given to the student on the beginning of each semester.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Fundamentals of Physics, 9th Edition, by David Halliday, Robert Resnick, Jearl Walker, Wiley; 9th Edition, Binder Ready Version edition (March, 2010).
Essential References Materials	University Physics with Modern Physics, Volume 2 (14th Edition), by Hugh D. Young, Roger A. Freedman, Pearson; (January 9, 2015)
Electronic Materials	The website of the faculty member
Other Learning Materials	Lab manual.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classrooms, equipped laboratories and library.

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	NA

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment, Quality of learning resources	Students	Each student evaluates the course by completing the online assessment form on the student's website at the end of each semester. The course instructor will then collect the data and send the Feedback to the relevant committee.
Effectiveness of teaching and assessment, Quality of learning resources	Faculty members	All course instructors meet Periodically and discuss the issues and potential areas of improvements. The final suggestions are always taken into consideration by the coordinator of the course.
Effectiveness of teaching and assessment, Quality of learning resources	Instructor from another faculty.	Feedback evaluation by relevant committee in the physics department.
Extent of achievement of course learning outcomes	Accreditation committee in the university.	Feedback evaluation by relevant committee in the physics department.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Level Four

Theoretical Methods in Physics (1) 4032141-4

Animal Physiology (1) 4013331-3

Modern Physics 4032150-4

Biomechanics 4032293-3

COURSE SPECIFICATION

Course Title:	**Theoretical Methods in Physics (1)**
Course Code:	**4032141-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm AL-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4	
2. Course type	
a. University ☐ College ☐ Department ● Others ☐	
b. Required ● Elective ☐	
3. Level/year at which this course is offered: 4	
4. Pre-requisites for this course (if any)**: Differentiation and Integration (2) (4042501-4)**	
5. Co-requisites for this course (if any)**:**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4	100
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	60
2	Laboratory/Studio	
3	Tutorial	
4	Exams and Quizes	8
	Total	68
Other Learning Hours*		
1	Study	105
2	Assignments	15
3	Library	
4	Projects/Research Essays/Theses	
5	Exams and Quizes	20
	Total	140

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course provides a direct preparation for an advanced study in theoretical physics and is also an interesting element in the education of an experimental physicist. The physical principles behind the mathematical models are stressed so that insight and problem solving ability become primary. This course will cover the basic mathematical tools used in physical science and engineering: Vector analysis, partial differentiation, power and series, differential equations, special functions, integral transforms, and complex analysis. The course is designed to supply students for a variety of mathematical methods that need for advanced undergraduate and beginning graduate study in physical science and to develop a solid background for those who will continue into the mathematics of advanced theoretical physics

2. Course Main Objective

This course is designed to demonstrate and consolidate the different concepts of mathematics and algebra and ways of using them in the different branches of physics

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Recognize facts, principles and concepts of treating with vectors and scalars in mathematics and algebra	K2, I
1.2	Reproduce structured series of events and numbers in the form of Algebraic series.	K2, I
1.3	Describe physics problems in terms of mathematical expressions like partial differential equations and special functions	K2, I
2	**Skills:**	
2.1	Differentiate between the mathematical methods to be used for of interpreting physics problems	S1, I
2.2	Interpret special mathematical and algebraic functions and partial differential equations in Physics using suitable mathematical principles	S2, P
2.3	Discuss numerical and quantitative events and results in terms of mathematical series and special functions.	S2, M
3	**Competence:**	
3.1	Show responsibility for self-learning to be aware with recent developments in physics	C2, M
3.2	Work effectively in groups	C1, M

C. Course Content

No	List of Topics	Contact Hours
	❖ **Vertor Analysis** 8- Triple (Scalar-Vector) products- 9- Differentiation of vectors- 10- grad, Div, Curl and Laplace's operator, 11- Vector integral- 12- Green's, Gauss' and Stokes theorems, **13-** General curvilinear coordinates- **14-** vector operators in orthogonal curvilinear coordinates	12
	❖ **Infinite series, Power series** 14- Geometric series, 15- testing series for convergence, 16- Alternating series, 17- interval of convergence- 18- expanding functions in power series, 19- Taylor and Maclaurin expansions, 20- Solving Problems about Series	8
1	❖ **Partial Differentiation** 1- Total differentials- 2- Approximating using differentials, 3- chain rule 4- Implicit differentiation, A 5- pplication to Maximum and Minimum problems, 6- Lagrange Multipliers, Change of Variables, Differentiation of Integrals	12
2	❖ **Fourier series and transforms** 1- Simple Harmonic Motion and Wave Motion; 2- Periodic Functions, 3- Average Value of a Function, 4- Fourier Coefficients, 5- Complex Form of Fourier Series, 6- Even and Odd Functions, 7- Applications of Fourier Series, Fourier Transforms	12
3	❖ **Ordinary differential equations** 1- First order differential equations; 2- separable differential equations, 3- linear 1st order equations, 4- 2nt order differential equations; 5- Homogeneous differential equations, 6- Non-homogeneous differential equations	8
4	❖ **Solution of Differential Equations by Laplace Transforms** 1- The Laplace Transform, 2- Convolution, 3- The Dirac Delta Function, 4- A Brief Introduction to Green Functions	8

Total	60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize facts, principles and concepts of treating with vectors and scalars in mathematics and algebra	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	Solve some example during the lecture. Exams: a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final) d) Discussions during the lectures. Home work. Discussions during the class.
1.2	Reproduce structured series of events and numbers in the form of Algebraic series.		
…	Describe physics problems in terms of mathematical expressions like partial differential equations and special functions		
2.0	**Skills**		
2.1	Differentiate between the mathematical methods to be used for of interpreting physics problems.	1. Preparing main outlines for teaching 2. Following some proofs 3. Define duties for each chapter 4 .Encourage the student to look for the information in different references 5. Ask the student to attend lectures for practice solving problem	1. Midterm's exam. Exams, short quizzes 2. Asking about methods previously taught 3. Discussions of how to simplify or analyze some phenomena
2.2	Interpret special mathematical and algebraic functions and partial differential equations in Physics by suitable mathematical principles		
…	Interpret numerical and quantitative events and results in terms of mathematical series and special functions.		
3.0	**Competence**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	• Search through the internet and use the library. • Small group discussion. • Enhance educational skills. • Encourage the student to attend lectures regularly Give students tasks of duties	• Evaluate the scientific values of solutions. • Evaluate work in team • Evaluation of role of each student in group assignments • Evaluation of students presentations
3.2	Work effectively in groups		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	1st Periodic Exam	Week 9	20%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
2	2nd Periodic Exam	Week 13	20%
3	Attendance and homeworks	Over the term period	10%
4	Final Exam	Week 15	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Students are supervised by academic advisers in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1- Mary L. Boas, Mathematical methods in the Physical sciences, second edition, John Wiley and Sons (1966) and (1983). 2- G. Dennis Zill, R. Michael Cullen, Advanced engineering mathematics, Jones and Bartlett Publisher (2006), ISBN 9780763745912.
Essential References Materials	
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course reports	Course professor	Students grades
Students Achievements.	Other staff	Revision of student answer papers by other staff members.
Analysis of students grades.	Course supervisor	Evaluation of grades distribution
Students assessment of the course	Students	

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Mohamed Salaheldin
Reference No.	
Date	13/11/2019

COURSE SPECIFICATION

Course Title:	Animal Physiology (1)
Course Code:	4013331-3
Program:	General Biology
Department:	Department of biology
College:	Faculty of Applied Science
Institution:	Um Al-Qura University

Table of Contents

A. Course Identification

1. Credit hours: 3 hours.			
2. Course type			
a. University ☐	College ☐	Department ✓	Others ☐
b. Required ✓	Elective ☐		
3. Level/year at which this course is offered: 3^{rd} Year / Level 5.			
4. Pre-requisites for this course (if any): Biochemistry (4012172-3).			
5. Co-requisites for this course (if any): NA.			

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	50
2	Blended	-	-
3	E-learning	-	-
4	Correspondence	-	-
5	Other	30	50

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	30
2	Laboratory/Studio	42
3	Tutorial	-

4	**Others** (specify)	30
	Total	102
Other Learning Hours*		
1	**Study**	30
2	**Assignments**	8
3	**Library**	15
4	**Projects/Research Essays/Theses**	10
5	**Others** (specify)	-
	Total	63

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course aims to develop critical thinking skills, to apply physiological concepts and principles at the basic and applied levels, to develop a working knowledge of the major physiological systems, and to associate anatomical areas with their specific function. The main topics concentrate on the microscopic structure and functions of integumentary, digestive, circulatory, respiratory and excretory systems.

2. Course Main Objective

After completing this course, students should be able to:

- **Develop critical thinking skills and be able to apply physiological concepts and principles at the basic and applied levels especially about digestion, blood and circulation, respiration, excretion.**
- **Develop a working knowledge of the major physiological systems, and be able to associate anatomical areas with their specific function.**

- **Develop an understanding of the role of evolutionary processes (e.g. natural selection) in driving the organization of physiological systems.**
  Understand important physiological challenges animals face, how those challenges vary in relation to the animals' environment, and the processes by which animals deal with these challenges.
- **Identify and describe structural differences of major physiological systems that characterize different taxonomic groups of animals.**
- **Relate physiological processes, from the biochemical to the system level, to the function of the entire organism in its environment.**
- **Learn to properly and safely use animals and modern laboratory equipment to conduct physiological research.**

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Identify and describe the specific functions of the studied organs	
1.2	Know the anatomical, microscopical anatomy and functions of: integumentary, digestive, circulatory, respiratory and excretory systems.	
1.3	Learn physiological concepts and principles of anatomical and physiological functions.	
1.4	Assimilate the basis of hematology, hemostasis, blood structure and functions. Student should know hemostasis, food digestion, absorption.	
1.5	Understand mechanisms of hemostasis, food digestion, absorption; blood circulation, organ and systemic blood supply, portal circulation.	

	CLOs	Aligned-PLOs
1.6	**Recognize** the blood circulation: Systemic circulation (Organ and systemic blood supply), portal circulation (hepatic and kidney portal blood supply) and how gases are exchanged.	
1.7	**Realize** mechanisms of respiration and gas exchange and immune response.	
1.8	**Acquire** the absorption and metabolism of carbohydrates, protein and lipids, in addition, the mechanisms of cell respiration and excretion.	
1.9	**Identify** the basis of hematology, hemostasis, blood structure and functions	
2	**Skills:**	
2.1	**Explain** the anatomy, microscopic anatomy and physiology of integumentary, digestive, circulatory, respiratory and excretory systems.	
2.2	**Distinguish** the structure and functions of digestive glands, in addition, endocrine glands.	
2.3	**Describe or draw** the anatomical and microscopic structure of: skin, digestive organs, heart and blood vessels, respiratory and excretory organs, in addition, diagram that explain mechanisms of their physiological activities.	
2.4	**Define** metabolic, respiratory and excretory mechanisms.	
2.5	**Apply** / measure some practical physiological applications.	
2…		
3	**Competence:**	
3.1	Developing oral presentations and leader ship activity	
3.2	Communicating personal ideas and thoughts	

CLOs		Aligned-PLOs
3.3	Work independently, Self-learning and as part of a team,	
3.4	To examine, describe, draw, dissect or contribute reports.	

C. Course Content

No	List of Topics (16 weeks)	Contact Hours
1	Definitions, physiology of cell membrane, feedback mechanism and hemostasis. Study physiological concepts and principles of anatomical and physiological functions.	2
2	Study: Anatomical, microscopical anatomy and functions of: integumentary system.	2
3	Digestive system: Structure and function of digestive system: Microscopic anatomy of esophagus, stomach, duodenum, small and large intestine. Quiz exam	2
4	Digestive system: Digestive glands (salivary glands, liver, biliary system, pancreas). Structure and function of saliva, bile and pancreatic secretion. Mechanism of digestion, absorption and role of enzymes in digestion. Quiz exam	2
5	Digestive system: Metabolism.	2
6	Midterm exam	2
7	Circulatory system and Circulation: structure and function of the heart and blood vessels, heart sounds.	2

8	Circulatory system and Circulation: Systemic, pulmonary and portal circulations.	2
9	Study basis of hematology, hemostasis, blood structure and functions	2
10	Basis of immunity	2
11	Structure and function of respiratory system.	2
12	Mechanisms of respiration, exchange of gases, mechanism of Inspiration and exhalation.	2
13	Structure and function of excretory system: Kidney; nephrons, ureters, urinary bladder, urethra.	2
14	Mechanisms of excretion.	2
15	Revision	2
16	Final exam.	
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Identify and describe the specific functions of the studied organs	1. Explain the structure and functions of skin, digestive, circulatory, respiratory, endocrine and excretory systems. 2. Lectures and student research papers. 3. The using of visual display such as PowerPoint.	- Homework and Quizzes. - Midterm and final written exams. - Evaluation of reports. - Group discussions and participation in the lecture.
1.2	Know the anatomical, microscopical anatomy and functions of: integumentary, digestive, circulatory, respiratory and excretory systems.		
1.3	Learn physiological concepts and principles of anatomical and physiological functions.		
1.4	Assimilate the basis of hematology, hemostasis, blood structure and functions.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	Student should know hemostasis, food digestion, absorption.	4. Homework assignments. Discussions (connecting what they learn in the class and applying this information in laboratory).	Course work reports.
1.5	Understand mechanisms of hemostasis, food digestion, absorption; blood circulation, organ and systemic blood supply, portal circulation.		
1.6	Recognize the blood circulation: Systemic circulation (Organ and systemic blood supply), portal circulation (hepatic and kidney portal blood supply) and how gases are exchanged.		
1.7	Realize mechanisms of respiration and gas exchange and immune response.		
1.8	Acquire the absorption and metabolism of carbohydrates, protein and lipids, in addition, the mechanisms of cell respiration and excretion.		
1.9	Identify the basis of hematology, hemostasis, blood structure and functions		
2.0	Skills		
2.1	Summarize the Physiological basis of Digestive, circulatory, respiratory, excretory systems. Practical activities,	5. Interactive lectures. 6. Seminars. 7. Participation of students in discussions during the lecture.	- Exam must contain questions that can measure these skills. - Quiz and exams. - Discussions after the lecture.
2.2	Categorize factors affecting on the biological processes and recording physiological parameters		
2.3	Apply some physiological experiments "lab applications".		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	Submit individual or team reports	8. Trying to explain the issues in regular and motivated manner. Follow up the students in lab and during carryout all analytical techniques.	Practical exam.
2.4	Develop critical thinking skills to apply physiological concepts and principles at the basic and applied levels.		
2.5	Relate physiological processes, from the biochemical to the system level, to the function of the entire organism in its environment.		
2.6	Dealing, safely, with lab animals and modern laboratory equipment to conduct practical physiological applications.		
2.7	Differentiate between physiological functions at cellular, tissue, organ at system levels.		
2…			
3.0	Competence		
3.1	Personal leader ship activity	Follow up, correction, reorientation of their work. Discussion	Evaluation, oral exam, Written exam
3.2	Teamwork activity		
3.3	Reports and presentations		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical Exam(s)	4	10 %
2	Mid Term Exam (Theoretic)	8	20 %

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	Mid Term Exam (practical)	9	10 %
4	Reports and essay	11	5 %
5	Final Practical Exam	15	15 %
6	Final Exam	16	40 %
	Total		100 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
2 Office hours/week

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Animal Physiology, Second Edition, Richard W. Hill, Gordon A. Wyse, and Margaret Anderson, 2008**

	Gerard, et al., (2008). Principles of Anatomy and Physiology John Wiley & Sons Inc., USA. Lauralee Sherwood , Hillar Klandorf, Paul Yancey (2012) Animal Physiology: From Genes to Organisms, Brooks Cole, USA.
Essential References Materials	Stuart I Fox (2010) Human Physiology, Kindle Edition, McGraw-Hill, USA.
Electronic Materials	https://www.edx.org https://www.coursera.org/learn/physiology
Other Learning Materials	CD prepared by the staff members containing U-tube videos. Biological charts, field trips

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	The areas of class rooms are suitable, concerning the number of enrolled students; and air conditioned. Lecture room equipped with a black board and Data show. Instructors use their own laptop. Physiology lab well equipped.
Technology Resources (AV, data show, Smart Board, software, etc.)	Class rooms are already provided with data show, audio-visual equipment.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Laboratory instruments & equipment: Cooling centrifuge, pH meters, flasks, beakers, screw capped tubes, slides and tips and chemicals kits.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students.	Class room discussions. Questionnaires.
Evaluation of Teaching	Instructor or by the Department	Revision of student answer paper by another staff member. Analysis the grades of students.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Prof. Dr. Hamid Mutwally; Prof. Osama Mohamed Sarhan; Dr. Zuhair Alsahhaf; Dr Azzam Alyakoob.
Reference No.	
Date	21/11/2019

COURSE SPECIFICATION

Course Title:	**Modern physics**
Course Code:	**403350-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 4								
2. Course type								
a.	University	☐	College	☐	Department	✓	Others	☐
b.	Required	✓	Elective	☐				
3. Level/year at which this course is offered: Level 4/ 2nd year								
4. Pre-requisites for this course (if any)**: Method in theoretical physics 1 code/ 403243-2**								
5. Co-requisites for this course (if any)**:**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	42
3	Tutorial	
4	Others (specify)	8
	Total	95
Other Learning Hours*		
1	Study	45
2	Assignments	15
3	Library	
4	Projects/Research Essays/Theses	15
5	Others (specify)	15
	Total	90

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course concern to by study the lows of physics phenomenas and their applications in physics. This course provides students a sufficient background on the basics of modern physics enabling students to take more courses that are advanced in physics.

2. Course Main Objective

For students undertaking this course, the aims are to:

1- **Understand** basics of the spatial theory of the relativity.
2- **Understand** the basic of the radiation of black body and objects.
3- **Use** the phase and group velocities.
5- **Realize** description of atom structure (Atomic models, Alpha-particle scattering, The Rutherford scattering formula, Nuclear dimensions, Electron orbits, Atomic spectra, The Bohr atom, Energy levels and spectra, Nuclear Motion, Atomic excitation, The correspondence Principle).
6- **Discuss** information about particles proprieties of waves
7- **Understand** the différents physics phenomena (The photoelectric effect, The quantum theory of light, X rays X-ray diffraction, The Compton effect, Pair production)
8- **Analyse** the UV catastrophe.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	**Define** the inertial reference frame, Galilean relativity, black body , UV catastrophe model of atomic structure.	K1-1.1
1.2	**Describe** De Broglie waves, Wave function, De Broglie wave velocity, The diffraction of particles, The uncertainty principle, Applications of the uncertainty principle, The wave-particle duality	K2-1.2
2	**Skills:**	
2.1	**Apply** physical principles on day life phenomena.	S1-2.1
2.2	**Derive** the physical laws and formulas related to (the modern physics laws, Bragg, Wien, DeBROGLIE, Compton, Heisemberg,,,,).	S2-2.2
2.3	**Analyse** the quantitative results.	S3-2.3
3	**Competence:**	
3.1	**Show** responsibility for self-learning to be aware with recent developments in physics.	C1-3.1
3.2	**write** scientific reports.	C2-3.2
3.3	**Work** effectively in groups.	C3-3.3
3.4	**Acquire** the skills to use the internet communicates tools.	C4-3.1

C. Course Content

No	List of Topics	Contact Hours
1	**THE SPATIAL THEORY OF THE RELATIVITY:** • Reference frame, inertial reference frame, Galilean relativity, • Einstein's postulate of relativity, relativity of the simultaneity, • Time dilatation, length contraction, Lorentz transformations, relativistic velocity transformations, • Relativistic mechanics, mass, energy, transformation of energy, momentum and force, • Doppler effect, Relativistic collisions, • Examples.	12
2	**PARTICLE PROPERTIES OF WAVES:** • The photoelectric effect, The quantum theory of light, • Radiation of heated objects, thermal radiation, cavity radiation treated with classical physics, • UV catastrophe, Planck's solution, quantum of energy, • The photoelectric effect, The quantum theory of light, • X rays X-ray diffraction, • The Compton effect, • Pair production, • Gravitational red shift, • Examples.	10
3	**WAVE PROPERTIES OF PARTICLES:** • De Broglie waves, • Wave function, • De Broglie wave velocity, • Phase and group velocities, • The diffraction of particles, • The uncertainty principle, • Applications of the uncertainty principle, • The wave-particle duality, • Examples.	10
4	**ATOMIC STRUCTRUE:** • Atomic models, • Alpha-particle scattering, • The Rutherford scattering formula, • Nuclear dimensions, • Electron orbits, • Atomic spectra,	13

	• Energy levels and spectra, • Nuclear Motion, Atomic excitation, • The correspondence Principle) • Examples.	
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	**Define** the physical quantities (Phase and group velocities, Energy levels and spectra, Time dilatation, length contraction,,,).	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams. 3. Lecturing method: Board, Power point. 4. Discussions. 5. Brain storming. 6. Start each chapter by general idea and the benefit of it.	- Solve some example during the lecture. - Discussions during the lectures Exams: a) Quizzes, b) Short exams (mid-term exams), c) Long exams (final), d) Oral exams.
1.2	**Describe** the Wave function, photoelectric effect, Electron orbits and generalized lows using mathematics formula.		
2.0	**Skills**		
2.1	**Apply** physical principles on day life phenomena.	1. Preparing main outlines. 2. Following some proofs. 3. Define duties for each chapter. 4. Encourage the student to look for the information in different references.	1. Exams (Midterm, final, quizzes), 2. Asking about physical, laws previously taught, 4. Discussions of how to simplify or analyze some phenomena.
2.2	**Derive** the physical laws and formulas related to physical phenomena.		
2.3	**Analyse** the quantitative results.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		5. Ask the student to attend lectures for practice solving problem.	
3.0	**Competence**		
3.1	**Show** responsibility for self-learning to be aware with recent developments in physics.	Inform the students about the followings: 1. How to search the internet and use the library. 2. How to cover missed lectures. 3. How to summarize lectures or to collect materials of the course. 4. How to solve difficulties in learning : solving problems – enhance educational skills. 5. Give students tasks of duties. 6. How to write reports. 7. How to work as a teamwork. 8. How to lead a teamwork.	Evaluate the scientific reports, the team work, and evaluate the efforts of each student in preparing the report.
3.2	**write** scientific reports.		
3.3	**Work** effectively in groups.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Mediterm Exam 1	6^{th}	10%
2	Midterm Exam 2	12^{th}	10%
3	Experimental lab.	All weeks	20%
4	Exercieses & Homeworks	All weeks	10%
5	Final Exam	End of the semester	50%
	Total		**100%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each student will supervise by academic adviser in physics department and timetable for academic advice were given to the student each semester. (2hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1-Jeremy Bernstein, Paul Fishbane and Stephen Gasiorowicz , Modern Physics, 2-Hardback (2000). 2-Randy Harris, Modern Physics (2nd Edition), International Edition 3-A. Beiser (2003). Concepts of Modern Physics (6th ed.). McGraw-Hill
Essential References Materials	• A. Beiser (2003). Concepts of Modern Physics (6th ed.). McGraw-Hill
Electronic Materials	- Web Sites, Social Media, Blackboard, etc.
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Lecture room for 45 students, Black (white) boards. • Library.
Technology Resources (AV, data show, Smart Board, software, etc.)	• Class rooms provided with data show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching Strategies	Students	Questionaire

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of student assessment	Instructor	Exams
Extent of achievement of course learning outcomes	Students	Questionaire
Quality of learning resources	Students	Questionaire

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Physics Department – College of Applied Science – Umm Al-Qura University
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Biomechanics**
Course Code:	**4032293-3**
Program:	**B.Sc Medical Physics**
Department:	**Physics**
College:	**Applied Science**
Institution:	**Umm AL – Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type **a.** University ☐ College ☐ Department ☑ √ Others ☐ **b.** Required √ Elective ☐	
3. Level/year at which this course is offered: Level 6 / 3th Year	
4. Pre-requisites for this course (if any)**:** Fundamentals of medical Physics (4032280-4)	
5. Co-requisites for this course (if any)**:** NIL	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom (including Laboratory classroom)**	39	86.6%
2	**Blended**	6	13.3%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other**	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	47
Other Learning Hours		
1	**Study** (Private study)	70
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	20
3	**Library**	10
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2

	Total	107

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is dedicated to medical physics students to provides an overview of musculoskeletal anatomy, the mechanical properties and structural behavior of biological tissues, and biodynamics. Specific course topics will include structure and function relationships in tissues and organs; application of stress and strain analysis to biological tissues; analysis of forces in human function and movement; energy and power in human activity; introduction to modeling viscoelasticity of tissues.

2. Course Main Objective

1. Identify a given bone, ligament or muscle by name, anatomic location, or function.
2. Identify relationships between structure and function in tissues and the implications/importance of these relationships.
3. Analyze the forces at a skeletal joint for various static and dynamic human activities.
4. Calculate the energy expenditure and power required to perform an activity.
5. Analyze the stresses and strains in biological tissues, given the loading conditions and material properties.
6. Identify the appropriate viscoelasticity model for the mechanical behavior of a given biological tissue.

3. Course Learning Outcomes

C. Course Content

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Define the basic knowledge of the biomechanics and the related laws	K1
1.2	Outline different application of biomechanics and the application of the human body movement.	K3
2	**Skills:**	
2.1	Summarize general areas of human movement and their applications	S1
2.2	Apply the mechanical laws to the human different biological systems.	S1, S4
2.3	Illustrate information technology and modern computer tools to locate and retrieve scientific information relevant to computing in medicine.	S4
2.4	Appraise the cooperation through teamwork to assess and criticize various emergent problems.	S5
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	C4

CLOs		Aligned-PLOs
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.	C6

No	List of Topics	Contact Hours
1	**Chapter 1: Static Forces** 1.1 Equilibrium and Stability 1.2 Equilibrium Considerations for the Human Body 1.3 1.3 Stability of the Human Body under the Action of an External Force 1.4 Skeletal Muscles 1.5 Levers 1.6 The Elbow 1.7 The Hip **Exercises**: 1.7.1 Limping 1.8 The Back **Quiz 1** **Quiz 2**	9
2	**Chapter 2:** Friction Introduction Types of friction 2.1 Standing at an Incline 2.2 Friction at the Hip Joint **Solved problems** **Quiz 1**	3
3	**Chapter 3: Elasticity and Strength of Materials** **Elasticity** **1. Introduction** Elasticity **Elastic materials** Hook's Law Elastic modulus **2. Types of stress and strain** **2.1 Tensile and compressive stress and strain** a.Tensile stress b. Compressive stress Young's modulus Y i-Shear stress ii-Shear strain iii-Shear modulus S c. Volume stress (the pressure) and strain	9

	Volume strain. Structural Determinants of Compliance The difference between the Compliance of vein and artery. The pressure – volume graph of the vein and artery.	

4	**Chapter 4: Bone Mechanics**
	Elasticity and plasticity
	The stress-strain diagram for the ductile material
	The proportional limit
	Ductile materials
	Brittle materials
	Elastic hysteresis.
	Breaking stress
	Physics of Bone
	Types of Bone
	Composition of bone
	Mechanical properties
	Properties of bone
	Compressive and tensile loading of cancellous bone.
	Factors affecting strength.
	• Mechanical Properties of Living Tissues:
	    • Material Mechanical Properties
	    • Structural Mechanical Properties
	• What are the factors affecting the stress bearing capacities of the bone?
	• Stiffness and Resilience
	• Stiffness vs Strength
	• The stress-strain diagram for the ductile material compared to the brittle material and the human bone.
	• Comparsione between the behavior of bone with other solid materials (glass & metal)?
	• Mechanical Loading of Bone.
	• The Bone fracture Mechanics.
	    • (1) Tensile Loading.
	    • (2) Compressive Loading.
	    • (3) Shear Loading.
	    • (4) Bending Loading.
	    • (5) Torsional Loading.
	    • Combined bending & axial load
	• What are the advantages of trabecular bone over compact bone?
	• Physical Properties of compact bone:
	    • The density.
	    • Elasticity.
		12

	• Strength
	• Bone Tissue Characteristics:
	  • Homogenous Vs non-homogenous
	  • Viscoelasticity
	  • Isotropic Vs Anisotropic
	• **Factors Affecting Stress - Strain Diagram**
	  • Effect of Loading Rate.
	  • Effect of Loading Direction.
	  • Effect of Loading Type.
	• Factors Affecting Strength of The Bone
	  • Area
	  • Reduction in density
	  • Stress Concentration
	Solved problems	

5	**Chapter 5: The Motion of Fluids** 5.1. Bernoulli's Equation 5.2 Viscosity and Poiseuille's Law 5.3 Turbulent Flow 5.4. Circulation of the Blood 5.5 Blood Pressure 5.6 Control of Blood Flow 5.7 Energetics of Blood Flow 5.8. Turbulence in the Blood 5.9. Arteriosclerosis and Blood Flow 5.10 Powers Produced by the Heart 5.11 Measurement of Blood Pressure Solved problems Exercises: 5-1,5-2, 5-3, 5-4, 5-5. Quiz 1 Quiz 2 Quiz 3	12
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.1	Define the basic knowledge of the biomechanics and the related laws	- Classroom lectures -Tutorials and independent study assignments -Individually hand written assignments required use of library reference material and web sites to identify the information required to complete tasks. -E-learning through the university website.	- Graded homework. - Assignments. - Quizzes. -Oral Group Discussion. - Class tests (e.g. 15 minute multiple choice test on content on completion of each topic) with a defined ratio of the final assessment of the course. -Multiple choice knowledge item on final exam
1.2	Outline different application of biomechanics and the application on the human body movement.		
2.0	**Skills**		
2.1	Summarize general areas of human movement and their applications	- Explain and justify several unsolved examples and unsolved problems in lecture under the supervision of the instructor. - Encourage the students to analyze and enhance the medical images using certain image processing program packages (e.g. MATLAB, Image J software).	- Graded homework. - Class exams. - Final Exam. - Group and individual assignments require application of analytical tools in problem solving tasks. - Class participation.
2.2	Apply the mechanical laws to the human different biological systems.		
2.3	Illustrate information technology and modern computer tools to locate and retrieve scientific information relevant to computing in medicine.		
2.4	Appraise the cooperation through teamwork to assess and criticize various emergent problems.		
3.0	**Competence**		
3.1	Work effectively in groups as well as individuals.		
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.		
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	6 &14	40 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	--	--
5	Final Practical Exam	--	--
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Students are supervised by academic advisers in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	[1] Physics in Biology and Medicine, Paul Davidovits, 3rd edition, Academic Press is an imprint of Elsevier 2007. [2] Handbook of physics in medicine and biology, Robert Splinter, CRC Press Taylor & Francis Group, 2010. [3] Biophysics, Roland Glaser, spring-Verlag Berlin Heidelberg, New York, 5th, 2001
Essential References Materials	Medical Image Analysis journal, Elsevier Science Ltd. https://www.journals.elsevier.com/medical-image-analysis/
Electronic Materials	http://www.youtube.com/watch?v=lP57gEWcisY&feature=related http://www.youtube.com/watch?v=HuZLh_mS6iE
Other Learning Materials	1. The Microsoft Office for editing reports. 2. The Matlab and Image J software package to train the student about how making image processing.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	NA

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Level Five

Radiation Medical Physics (1) 4033285-4

Quantum Mechanics (1) 4033145-4

Physics of Cell membrane and macromolecules 4033298-2

Physics of Medical Laser 4033281-2

Physics of Medical Ultrasound 4033290-2

COURSE SPECIFICATION

Course Title:	**Medical Radiation Physics (1)**
Course Code:	**4033285-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Science**
Institution:	**Umm AL – Qura University**

Table of Contents

A. Course Identification

1. Credit hours: **(3+1+0) Hrs**			
2. Course type			
a. University ☐	College ☐	Department √	Others ☐
b. Required √	Elective ☐		
3. Level/year at which this course is offered: **3rd Year / Level 5**			
4. Pre-requisites for this course (if any)**:** **Fundamental of Medical Physics (4032280-4)**			
5. Co-requisites for this course (if any)**:**			

6. Mode of Instruction (mark all that apply

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom (including Laboratory classroom)**	40+39=79	90.8%
2	**Blended**	8	9.2%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5-	**Other**	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	**Laboratory/Studio**	42
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	89
Other Learning Hours*		
1	**Study** (Private study including the laboratory hours)	110
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	20
3	**Library**	20
4	**Projects/Research Essays/Theses**	5

5	**Others** (specify) (Oral Presentation, Assay)	2
	Total	157

***** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is interested in study the interactions of alpha, beta charged particles, gamma ray and neutrons with Matter., quantities and units in radiological physics. Moreover, this course is interested in study the types of radiation Sources; radioactivity, Transformation mechanisms, and transformation Kinetics. It interested in explaining machine sources of radiation such as x-ray tube, linear accelerator and cyclotron. It gives outline of the types personnel detectors , scintillation detectors, and explains biological effects in humans and outline on radiation protection for occupational workers in medical practices such as diagnostic x-ray, nuclear medicine and radiotherapy.

2. Course Main Objective

At the end of this course the students will be able to:

- Explain general aspects of radioactive decay processes; Beta decay, Alpha decay, electron capture.
- Outline of the types of radiation Sources; radioactivity, Transformation mechanisms, Transformation Kinetics.
- Explain Interactions of ionizing radiation with Matter by studying the interactions of alpha , beta charged particles , gamma ray and neutrons with Matter.
- State different types of personnel detectors
  Outline of the scintillation detectors

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Outline of the general aspects of radioactive decay processes; Beta decay, Alpha decay, Electron capture	K1
1.2	Describe types of radiation Sources; Radioactivity, Transformation Mechanisms, Transformation Kinetics	K2
1.3	Define Interactions of ionizing radiation with Matter by studying the :- 1.Interactions of alpha and beta charged particles with Matter	K4

CLOs		Aligned PLOs
	2,Interactions of gamma and uncharged particles with Matter	
1.4	Reproduce of X Rays: Accelerated Charged Particle, Linear Accelerator and X-ray machines.	K6
1.5	Outlines on the Radiation quantities and units , personnel dosimeters , biological effects in humans and radiation protection for occupational workers in medical practices	K5 and k6
2	**Skills:**	
2.1	Creating practical experiments for measurements radiation doses using thermoluminscence dosimeters..	S4
2.2	.Applying the mathematical calculation of the radiation doses using mathematical and computer software	S1
3.2	Carry out analyse of the obtained data and how to manage it.-	C1
3.3	. Make a certain decision fast especially during data acquisition.	C4
3.4	Enhancing the ability of students to use computers and internet.	C1
3.5	Justify a short report in a written form .	C6

Program learning Outcomes*

Knowledge: ***Summary description of the knowledge to be acquired and on completing this program, students will be able to:***	
K1	Acquire the major aspects of nature and subject of medical physics and the application of physics to medicine.
K2	List matter in various forms, including crystals, semiconductors, atoms, nuclei and understand the principles of laser and its application in medicine.
K3	Recognize Bioinformatics in order to know how to analysis data which is used to diagnose with the aid of different medical devices such as X- ray machines, gamma camera, accelerator and nuclear magnetic resonance.
K4	Define different quantitative, mathematical science and physical tools analyze problems and list some foundations of systems theory to solve and analysis different problems.
K5	Recognize the nature, properties, dosimetery of radiation and basics of radiation protection and also medical effects of ionizing and non-ionizing radiation.
K6	Outline the principles of physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics.
Skills: ***Summary description of the skills to be acquired and on completing this program, students will be able to:***	
S1	Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in medical physics and related fields of studies.
S2	Formulate and test hypotheses using appropriate experimental design and analysis of data (Computer simulation) and integrate IT-based solutions into the user environment effectively.

S3	Analyze and evaluate information by using computational tools to interpret experimental data relevant to medical physics by using packages from different theoretical and experimental resources, and perspectives.
S4	Operate some medical instruments such as that used for the diagnosis of different diseases in medical centers and demonstrate competency in laboratory techniques and safety.
S5	Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.
S6	Justify ethical, social and legal responsibilities concerning medical physics.
S7	
Competence: ***Summary description of the Competence to be acquired and on completing this program, students will be able to:***	
C1	Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of medical physics issues.
C2	Demonstrate scientific concepts and analytical argument, in a clear and organized way, verbally and in writing.
C3	Implement all kinds of relevant information in medical physics through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.
C4	Work independently and demonstrate the ability to manage time and to work as a part of a team, and learn independently
C5	Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.
C6	Summarize, document, report, and reflect on own findings.

C. Course Content

No	List of Topics	Contact Hours
1	Introduction Scientific Fundamental , atomic and nuclus structure , Excitation and Ionization, Characteristic x-ray. Binding Energy	3

2	Radiation Sources Radioactivity. Transformation Mechanisms : Alpha emission, Isobaric transitions: Beta emission, Positron emission and electron capture. Isomeric transitions: Transformation Kinetics Gamma rays and X-ray. Natural Source of Radiation Exposure. Naturally Occurring Radiation, cosmic radiation , cosmogenic radioactivity and primordial radioactivity. Human-Made Sources of Radiation Exposure Machine sources of radiation such as X Rays tube Linear Accelerator Cyclotron	18
3	**Interaction of radiation with matter** Alpha particle interactions, Beta particle interactions Specific ionization, Mass stopping power Linear energy transfer , Bremsstrahlung , X-ray production , Internal Conversion Electrons, gamma rays, expoentional absorption, half value layer and tenth value layer Pair production, Compton scattering and photoelectric absorption, photonuclear reaction and combined effect. Interaction of neutrons with matter Production, classification, interaction, scattering, absorption and neutron activation	18
4	Biological radiation effect and Radiation Protection Radiation quantities and units Biological effect in Humans: non stochastic effects and stochastic effects. Radiation protection concepts and principles Radiation Protection for occupational workers	6
Total		45

Practical part:

1.Calibration of Thermo Luminescent Dosimeters
1.1 Determination of Element Correction Coefficient
1.2 Determination of Reader Calibration Factor
1.3 Assessment of personal dose equivalent

2.1 Determination of half value layer
2.2 Determination of linear attenuation coefficients for different materials
3 verifications of inverse square law
4 Environmental monitoring for some selected locations
5 Detection of gamma rays using a scintillation counter
5.1 Energy calibration of NaI(Tl) detector
5.2 Resolution of NaI (Tl) detector
5.3 Measurements of Natural background radiation in some environmental samples
5.4 Assessment of activity of I-131 using neck and thyroid Phantom

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Outline of the general aspects of radioactive decay processes; Beta decay, Alpha decay, Electron capture	general idea of the meaning of radioactive decay process and the benefit of it. Demonstrate the course information and principles through lectures	1.Home work 2.Interactive 3.discussion 4.Short exam1 5Short exam2 6.Final exam
1.2	Describe types of radiation Sources; Radioactivity, Transformation Mechanisms, Transformation Kinetics	Describing types of radiation sources with solving problems	1..Presentations 2. .Quizzes 3. Problem solving
…1.3	Define Interactions of ionizing radiation with Matter by studying the :- 1.Interactions of alpha and beta charged particles with Matter 2,Interactions of gamma and uncharged particles with Matter	Select suitable Showing power point presentation for explanation the interaction of radiation with matter	1 Oral questions 2.Presentations 3. .Quizzes 4. Problem solving
1.4	Reproduce of X Rays: Accelerated Charged Particle, Linear Accelerator and X-ray machines.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.5	Outlines on the Radiation quantities and units , personnel dosimeters , biological effects in humans and radiation protection for occupational workers in medical practices	Manage the practical experiments .	1 Oral questions 2.Presentations 3 .Quizze 4. Problem solving
2.0	**Skills**		
2.1	Creating practical experiments for measurements radiation doses using thermoluminscence dosimeters..	Lectures	Exam must contain questions that can measure these skills.
2.2	.Applying the mathematical calculation of the radiation doses using mathematical and computer software	Brain storming -Discussion	Quiz and exams Discussions after the lecture
…			
3.0	**Competence**		
3.1	**At the end of the course, the student will be able to:** work effectively in a group to make a decision.	- Lab work -	Evaluate the efforts of each student in preparing the report. Evaluation of students presentations
3.2	Analyse obtained data and how to manage it. -	Case Study - Active learning -	Evaluate the scientific values of reports. Evaluate the work in team
3.3…	. Make a certain decision fast especially during data acquisition.	Small group discussion	Evaluation of the role of each student in lab group assignment.
3.4	Enhancing the ability of students to use computers and internet.	Homework (preparing a report on some topics related to the course depending on web sites).	Evaluation of presentations
3.5	Know how to write a report	Seminars presentation	Evaluation of reports
3.6	Perform effective communication with colleagues and faculty members	Field visits to hospitals	Practical exam

2. Assessment Tasks for Student

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	7-8 &13-14	20 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	11	10 %
5	Final Practical Exam	15	10%
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will supervise by an academic adviser in physics Department and the time table for academic advice were given to the student each semester. (2 hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1.Herman Cember and Thomas E. Johnson "introduction to Health Physics" 4th Ed. McGraw-Hill 2009. 2. Stabin " Radiation Protection and dosimetry" , Springer 20071. Stabin " Radiation Protection and dosimetry" , Springer 2007
Essential References Materials	1. Simon Cherry, Michael E. Phelps "Physics in Nuclear Medicine" 3rd add," Saunders 2003 2.Ervin B. Podgorsak "Radiation physics for medical physicists" Springer 2006.
Electronic Materials	ICRP web sities go to http:// ICRP.org/publications.asp

Other Learning Materials	Staff web site

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• The area of class room is suitable concerning the number of enrolled students (68) and air conditioned.
Technology Resources (AV, data show, Smart Board, software, etc.)	• Providing class rooms with computers and labs
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Quantum Mechanics 1**
Course Code:	**4033145-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:				
2. Course type				
a.	University √	College ☐	Department ☐	Others ☐
b.	Required √	Elective ☐		
3. Level/year at which this course is offered: **5th level / 3rd year**				
4. Pre-requisites for this course (if any)**:** Theoretical Methods in Physics 1(4032141-4) Linear Algebra (suggestion)				
5. Co-requisites for this course (if any)**:** Theoretical Methods in Physics 2 (4033142-4)				

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended	-	-
3	E-learning	√	-
4	Correspondence	-	-
5	Other (WhatsApp)	√	

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	60
2	Laboratory/Studio	0
3	Tutorial	0
4	**Others** (specify) Exams/ Quizzes	8
	Total	68
Other Learning Hours*		
1	Study	105
2	Assignments	15
3	Library	-
4	Projects/Research Essays/Theses	-
5	**Others** (specify) Exams/Quizzes	20
	Total	140

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description
2. Course Main Objective

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	The idea of the evolution of quantum mechanics using the concept of probability.	
1.2	Evolution of wavefunction with different potentials, concept of eigenvalue and eigenfunction, concept of tunneling,	
1.3	Energy and wavefuction of Hydrogen atom in spherical coordinates and other properties like angular momentum and spin.	
2	**Skills:**	
2.1	Ability to understand the situation	
2.2	Ability to use the correct of relavant mathematical too.	
3	**Competence:**	
3.1	.	
3.2	Knowledge about the relevant work going on around the world	

C. Course Content

No	List of Topics	Contact Hours
1	**Wave Particle duality, Probability and Schrodinger Equation** ▪ Radiation as particles, electrons as waves ▪ Plane waves and wavepackets ▪ The probability interpretation of the wavefunction ▪ The Schrodinger equation ▪ The Heisenberg uncertainty relation ▪ The probability current	8

	▪ Expectation values and the momentum in wave mechanics, wavefunction in momentum space	
2	particle **Eigenvalues , Eigenfunctions and the Expansion Postulate** ▪ The time-independent Schrodinger equation, ▪ Eigenvalue equation ▪ The eigenvalue problem for a particle in a box ▪ The expansion postulate and its physical interpretation ▪ Momentum eigenfunctions and the free particle, Normalization of the free wavefunction, Degeneracy ▪ Parity	8
3	**One-dimensional potential field** ▪ The potential step ▪ The potential wall ▪ The potential barrier ▪ An example of tunnelling ▪ Bound states in a potential well ▪ The harmonic oscillator	8
4	**The General Structure of Wave Mechanics** ▪ The eigenfunctions and eigenvalues, The Hamiltonian operator ▪ Other observables ▪ Vector spaces and operators ▪ Degeneracy and simultaneous observables ▪ The time dependence and the classical limit	8
5	**Angular Momentum** ▪ The angular momentum commutation relations ▪ Raising and lowering operatorsfor angular momentum ▪ Representation of |**l, m** > states in spherical coordinates.	4
6	**The Schrodinger Equation in Three Dimensions and Hydrogen Atom** ▪ The central potential ▪ The Hydrogen atom ▪ The energy spectrum ▪ The free particle	8
7	**Spin** ▪ Eigenstates of spin ½ ▪ The intrinsic magnetic moment of spin ½ particles ▪ Addition of two spins ▪ The addition of spin ½ and orbital angular momenta ▪ General rules for addition of angular momenta	8
8	**Matrix Repesentation of Operators** ▪ Matrices in quantum mechanics ▪ Matrix representation of angular momentum operators ▪ General relations in matrix mechanics ▪ Matrix representation of spin 1/2	8

Total	60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1		Stress on clearing the concept by relating examples	In-class questioning and discussion
1.2		Update the students by the relevant research, going on internationally relating to the topics under study.	Small project
…		Stress on discussion during the lecture	
2.0	**Skills**		
2.1	Control over using the mathematical tools	Telling different ways to handle a situation	
2.2	Problem solving	Assignments, In-class tutorials	Quiz, Midterm Exams, Final Exams
2.3	Using the correct approach	Relating the situations to the real world as much as possible	
3.0	**Competence**		
3.1	Knowledge about the relevant work going on around the world	Giving the information of relted international new research during lectures.	
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments	Every week	10
2	Quizzes	14th week	5
3	Midterm Exams	7th and 12th week	30
4	Questioning during lectures	Every week	5
5	Final exam	16th week	50

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : 4 hours per week

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	S. Gasiorowicz, 'Quantum Mechanics', *John Wiley & Sons, Inc.*, 3rd Ed.
Essential References Materials	David J. Griffiths, 'Introduction to Quantum Mechanics', *Pearson Prentice Hall, USA.*
Electronic Materials	https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2013/lecture-videos/
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom with a good whiteboard
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	--

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
This same course is taught to Medical physics students. Medical physics students don't	Incharge Medical Physics	For the remedy to this problem it is suggested that Linear Algebra should also be a pre-

Evaluation Areas/Issues	Evaluators	Evaluation Methods
have enough background for this course.		requisite for this course in addition to Theoretical Methods in Physics 1. Or Medical physics students should have a different course structure for Quantum Mechanics 1.
Students who do not take the course on Theoretical Methods 2 in the same semester, remain unfamiliar with many special functions like Bessel function, Leguerre function, error function etc., that are used in the course.	Faculty member teaching the course	It is suggested that Theretical Methods 2 should be a co-requisite of Quantum Mechanics 1.
Exam papers	Other faculty members	Direct peer review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Physics of Cell Membrane and Macromolecules**
Course Code:	**4034291-2**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Science**
Institution:	**Umm Al – Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type **a.** University ☐ College ☐ Department ☒ Others ☐ **b.** Required ☒ Elective ☐	
3. Level/year at which this course is offered: **Level 5/ Year 3**	
4. Pre-requisites for this course (if any): **Animal Physiology (4013331-3)**	
5. Co-requisites for this course (if any): **Not Applicable**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	25	83%
2	**Blended**	5	17%
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	30
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	32
Other Learning Hours		
1	**Study** (Private study)	45
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	15
3	**Library**	5
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2
	Total	72

* The length of time that a learner takes to complete learning activities that lead to the achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to introduce the students to the fundamentals of the cell membrane macromolecules basic structure. Also, the role of these constitutes for the cell membrane functions. In addition, the fluidity of cell affected by different factors. Moreover, the basics, electrical model circuit of the nerve cell (neuron), Nernest and Dannon equation.

2. Course Main Objective

After completing this course student should recognize the followings:

1. The meaning of the statement that phospholipids and most other membrane constituents (e.g., proteins) are amphipathic molecules.
2. How the fluid mosaic model of membrane structure explains each experimental finding:
   - **a**. actual membranes adhere more strongly to water than do artificial membranes composed only of phospholipids.
   - **b**. membranes with different functions may differ in type and number of membrane proteins.
   - **c**. membrane proteins are not very water-soluble.
3. The fluidity of the components of a cell membrane and explain how membrane fluidity is influenced by temperature and membrane composition.
4. How cholesterol resists changes in membrane fluidity as temperatures change.
5. Between peripheral and integral membrane proteins.
6. Six major functions of membrane proteins.
7. The role of membrane carbohydrates in cell-cell recognition.
8. The electrical properties of the cell membrane basic structure.
9. The two forces that combine to produce an electrochemical gradient.
10. How an electrogenic pump creates voltage across a membrane. Name two electrogenic pumps.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:** On successful completion of this course it is expected that students will be able to:	
1.1	Define the fundamental knowledge of cell membrane basic structure.	**K1**
1.2	Outline the major macromolecules of the eukaryotic plasma cell membrane.	**K1 & K2**
1.3	Recognize the essential electrical properties of the nerve cell membrane.	**K2**
1.4	State various techniques of to identify biological macromolecules.	**K6**

	CLOs	Aligned PLOs
2	**Skills:** On successful completion of this course it is expected that students will be able to:	
2.1	Recognize and validate problems; formulate and test hypotheses.	**S1**
2.2	Evaluate and formulate a theoretical concept. Evaluation includes originality, independence and applicability.	**S2**
2.3	Perform with supervision, a research project independently, including the formulation of the research question based on good general insight in the field, experimental design, implementation, and results analyses and reporting.	**S5 & S6**
2.4	Summarize, document, report, and reflect on own findings.	**S5**
3	**Competence:** On successful completion of this course it is expected that students will be able to:	
3.1	Carry out electronic research independently and knows how to formulate and express results and interpretations of the research outcomes. Then apply his/her knowledge and capabilities to analyze and carry out research in the physics of cell membrane filed and in not-familiar domains.	**K1 & C1**
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.	**C2 & C6**
3.3	Appraise the cooperation through teamwork to assess and criticize various emergent problems. In addition, work effectively in groups as well as individuals.	**C2 & C4**
3.4	The student knows how to participate in discussions, put forward his/her results both in a constellation of peers as well as for lay-people.	**C2 & C3**

Program learning Outcomes*

Knowledge: ***Summary description of the knowledge to be acquired and on completing this program, students will be able to:***	
K1	Acquire the major aspects of nature and subject of medical physics and the application of physics to medicine.
K2	List matter in various forms, including crystals, semiconductors, atoms, nuclei and understand the principles of laser and its application in medicine.
K3	Recognize Bioinformatics in order to know how to analysis data which is used to diagnose with the aid of different medical devices such as X- ray machines, gamma camera, accelerator and nuclear magnetic resonance.
K4	Define different quantitative, mathematical science and physical tools analyze problems and list some foundations of systems theory to solve and analysis different problems.
K5	Recognize the nature, properties, dosimetery of radiation and basics of radiation protection and also medical effects of ionizing and non-ionizing radiation.
K6	Outline the principles of physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics.
Skills: ***Summary description of the skills to be acquired and on completing this program, students will be able to:***	
S1	Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in medical physics and related fields of studies.

S2	Formulate and test hypotheses using appropriate experimental design and analysis of data (Computer simulation) and integrate IT-based solutions into the user environment effectively.
S3	Analyze and evaluate information by using computational tools to interpret experimental data relevant to medical physics by using packages from different theoretical and experimental resources, and perspectives.
S4	Operate some medical instruments such as that used for the diagnosis of different diseases in medical centers and demonstrate competency in laboratory techniques and safety.
S5	Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.
S6	Justify ethical, social and legal responsibilities concerning medical physics.
S7	
Competence: ***Summary description of the Competence to be acquired and on completing this program, students will be able to:***	
C1	Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of medical physics issues.
C2	Demonstrate scientific concepts and analytical argument, in a clear and organized way, verbally and in writing.
C3	Implement all kinds of relevant information in medical physics through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.
C4	Work independently and demonstrate the ability to manage time and to work as a part of a team, and learn independently
C5	Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.
C6	Summarize, document, report, and reflect on own findings.

C. Course Content

No	List of Topics	Contact Hours
1	**Chapter 1** • Animal Cell Structure Background • Basic Membrane Properties. • Lipids. • Proteins. • Models of cell membranes: ▪ Robert Hooke model. ▪ Charles Overton model. ▪ Gorter and Grendel model. ▪ Danielli and Davson model. ▪ Robertson model.	**4**

	▪ Singer and Nicolson model (Fluid Mosaic Model as a Cell Membrane Model). • Quizzes. Homeworks.	

2	**Chapter 2**
	• The Fluid Mosaic model General structure.
	• The Fluid Mosaic model plasma membrane main components:
	  • Lipids.
	    • The structure of the fatty acid forimg the basic lipid of the cell membrane.
	    • The major difference between saturated and unsaturated fatty acid.
	    • The architecture of the lipids in the polar medium (micelle, bilayer, and liposome).
	    • Basics plasma membrane lipids:
	      • Phospholipids.
	      • Glycolipids.
	      • Cholesterol, and their function's role
	    • Function of the basic lipid membrane in the plasma membrane.
	    • What is the relation between fatty acid saturation type and the van der Waals forces that packing the lipids together?
	  • Proteins.
	    • The proteins form mainly two classes:
	      • (a) Peripheral (extrinsic) proteins.
	      • (b) Integral (intrinsic) proteins.
	      • In addition to lipoprotein.
	    • Function of the basic protein membrane in the plasma membrane.
	  • Carbohydrates.
	    • In general, they are found on the outside surface of cells and are bound either to proteins (forming **glycoproteins**) or to lipids (forming glycolipids).
	    • Function of the basic carbohydrates membrane in the plasma membrane.
		6

	• Quizzes. Homeworks.	

3	**Chapter 3**
	• Cell membrane fluidity.
	  ○ Factors affecting cell membrane fluidity.
	    ▪ Temperature.
	    ▪ Lipid fatty acid composition.
	    ▪ Cholesterol content.
	  ○ Discussion of how cell membrane fluidity depends on temperature.
	  ○ Discussion of how cell membrane fluidity depends on lipid the fatty acid composition.
	  ○ Discussion of how cell membrane fluidity depends on Cholesterol content.
	• Quizzes.
	• Homeworks.
		5

4	**Chapter 4**
	• Cell Membrane Physics
	• Introduction to Neurology:
	  ○ The central nervous system.
	  ○ The peripheral nervous system.
	  ○ Sensory nerve cell.
	  ○ Motor nerve cell (neuron).
	    ▪ Basic structure of the neuron (Cell Body, Dendrites, Axon, Synapse (axon terminals)).
	    ▪ Axon Termini and Synapses
	    ▪ Types of Synapses.
	      • Electrical Synapses.
	      • Chemical synapses.
	        ○ Excitatory.
	        ○ Inhibitory
	  ○ Electrical Potential of Nerves.
	    ▪ Resting Membrane Potential (RMP).
	    ▪ Action Potential (Propagation of Nerve impulse).
	  ○ Electrical Properties of Neurons.
	  ○ There are two different types of nerve fibers:
	    ▪ Myelinated Nerves.
	    ▪ Unmyelinated nerves.
		6

	▪ The transmission of nerve impulse along an unmylinated axon. ○ Steps of action potential to propagate nerve impulse. ○ Saltatory Conduction. • Quizzes. Homeworks.	
5	**Chapter 5** • Electrical properties of neurons. • Electrical circuit equivalent neuron: ○ Resistivity and Resistance of axoplasm ▪ Resistivity for an unmyelinated axon. ▪ Resistivity for a myelinated axon. ▪ Resistance for an unmyelinated axon. ▪ Resistance for a myelinated axons. ▪ The capacitance per unit area for unmyelinated axons. ▪ The capacitance per unit area for myelinated axons. ○ Interpretation of Impulse Propagation: ▪ Propagation speed for unmyelinated axons. ▪ Propagation speed for myelinated axons. ○ Solved problems. ○ Unsolved problems. • Electrical properties of cell membrane. ○ Membrane potential (E_m) ○ Electrogenic pump. ○ Equilibrium potential ○ Nernst potential; or diffusion potential. ○ Membrane Equilibrium (Nernest) Potenial Equation for certain ion (e.g. Na^+, K^+, Cl^-). ○ Donnan Equilibrium. ○ Affect of Donnan equilibrium. ○ Derivation of Dannon Equilibrium Equation. ○ Resting Membrane Potential (R.M.P) . ○ Calculation of Resting Membrane Potential (R.M.P.). ○ Conductance (G) of the cell membrane. • Some physical techniques to separate macrolmolecules: ○ Isolated of proteins by centrifugation. ○ Using spectroscopic techniques to identify molecular weight. ▪ Bear-Lambert law. ▪ Derivation of Bear Lambert law ○ SDS-PAGE (Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis)	**9**

	• Quizzes. • Homeworks.	
Total		**30**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the fundamental knowledge of cell membrane basic structure.	• Lectures • In-class discussions • Exercises • Open discussion • Internet search	• Graded homework. • Assignments. • Quizzes. • Oral Group Discussion. • Class Test Exam(s) • Final exam
1.2	Outline the major macromolecules of the eukaryotic plasma cell membrane.		
1.3	Recognize the essential electrical properties of the nerve cell membrane.		
2.0	**Skills**		
2.1	Recognize and validate problems; formulate and test hypotheses.	• Lectures. • Problem solving • Case study.	-Individual homework problems and assignment tasks - Group and individual assignment tasks - Students are encouraged to understand problems rather than just memorizing various problem types. - Performance in the class and on the exams
2.2	Evaluate and formulate a theoretical concept. Evaluation includes originality, independence and applicability.	• Lectures • Problem solving • Small group work • Open discussion • Internet search	
2.3	Perform with supervision, a research project independently, including the formulation of the research question based on good general insight in the field, experimental design, implementation, and results analyses and reporting.	• Lectures • An awareness of time management in completing their reports. • Encourage students to help each other • Group assignments	
2.4			
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Carry out electronic research independently and knows how to formulate and express results and interpretations of the research outcomes. Then apply his/her knowledge and capabilities to analyze and carry out research in the physics of cell membrane filed and in not-familiar domains.	• Directing the student to self-learning and a greater knowledge in the field of course • Tutorial Classes. • Encourage students to think critically and involve in discussions with the instructor in classroom. • Oral presentations on related topics will be held in class weekly • Work independently and as part of a team. • Encourage peer discussion and offer one to one discussion • Building up a friendly relationship between instructor and students, so that students can understand more on the subject • Giving consultation	• Assessments of student's assignments. • Evaluation of group reports and individual contribution within the group. • Reports and presentations. • Instructor's feedback • Final and short exams include different problems which need numerical and technical skills.
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.		
3.3	Appraise the cooperation through teamwork to assess and criticize various emergent problems. In addition, work effectively in groups as well as individuals.		
3.4	The student knows how to participate in discussions, put forward his/her results both in a constellation of peers as well as for lay-people.		
3.5			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	5 %
2	Class Test Exam (Two Written Tests)	6 &14	40 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	3-16	5 %
5	Final Practical Exam	--	--
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Faculty members dedicate 6 hours at least every week for office hours, during which students are encouraged to visit their instructor for help, conversation practice and clarifying difficult concepts. The Academic Management Unit also supervises a Student Support Committee that provides additional tutoring and help to weaker students or students who were registered late by the university. There is also a Special Educational Needs coordinator who helps students with special needs.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1-Thermal Biophysics of Membranes. Thomas Heimburg, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2007. 2- Membrane Biophysics: New Insights and Methods, Hongda Wang and Guohui Li, 1st Edition, Springer Nature Singapore Pte Ltd, 2018. 3- Essential Cell Biology, Bruce Alberts et al., 4th Edition, Garland Science, Taylor & Francis Group, LLC, an Informa Business, 2014. 4- Handbook of Physics in Medicine and Biology, Robert Splinter, CRC Press is an imprint of Taylor & Francis Group, an Informa business, 2010.
Essential References Materials	[1] Structural Biology with Biochemical And Biophysics Foundation by Mary Luckey, 1st edition, Cambridge University Press, 2008. [2] Cell Biology and Membrane Transport Processes by Michael Caplan, Intenernational Edition, Academic Press, 1994.
Electronic Materials	https://www.sciencedirect.com/bookseries/membrane-science-and-technology/vol/7/suppl/C https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3456180/ https://www.cell.com/biophysj/home
Other Learning Materials	1. The Microsoft Office for editing reports. 2. The Matlab and Image J software package to train the student about how making image processing

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• There are enough classrooms provided with a good accommodation, including good air condition, good data show slide projector, and suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show slides, Overhead projector, whiteboard, course book software, internet, speakers, printers, photocopiers, and laptops for teachers. • E-learning 2DL system. • Student correspondence system.
Other Resources	• Not applicable (as the course doesn't have a laboratory section.

Item	Resources
(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement, of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Physics of Medical Laser**
Course Code:	**44033281-2**
Program:	**B.Sc Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm AL – Qura University**

Table of Contents

A. Course Identification

1. Credit hours:								
2. Course type								
a.	University	☐	College	☐	Department	√	Others	☐
b.	Required	√	Elective	☐				
3. Level/year at which this course is offered: Level 5/3rd Year								
4. Pre-requisites for this course (if any)**:** Fundamentals of medical Physics (4032280-4)								
5. Co-requisites for this course (if any)**:**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	25	83%
2	**Blended**	5	17%
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	30
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	32
Other Learning Hours		
1	**Study** (Private study)	45
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	15
3	**Library**	5
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2
	Total	72

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is dedicated to medical physics students to teach and introduce the uses of LASER in medicine and surgeries. It starts with describing the atom, and excitation. It then describes how LASER is formed and the associated conditions for LASER formation. It also introduces various types of LASER like gas LASER, Solid LASER and Dye LASER. Next, it describes how the laser beam is transferred in fibers and the biological effects on the different human tissues. Finally it gives an introduction to the laser applications in ophthalmology as an example.

2. Course Main Objective

Study of Laser formation from 2, 3 and 4-level laser
Study of the optical cavity conditions for Laser formation
Study of some real Laser system like CO2 , He-Ne, Semiconductor, Ruby Lasers
Laser Safety and Laser transportation
Applications of Laser on Ophthalmological surgery.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:** On successful completion of this course it is expected that students will be able to:	
1.1	Recognize facts, principle and concepts of laser science and its medical applications.	K1, K2
1.2	Applying basic information to the use of laser in medicine such as ophthalmology, dentistry, Cosmology.	K1, K2
2	**Skills:** On successful completion of this course it is expected that students will be able to:	
2.1	Solve problems in physics by using suitable Laser scientific principles and facts.	S1
2.2	Acquire the skills to use the internet communicates tools.	S3
2.3	Show responsibility for self-learning to be aware with recent developments in physics	S3, S5
2.4	Work effectively in groups as well as individual.	S5, C4
3	**Competence:** On successful completion of this course it is expected that students will be able to:	

CLOs		Aligned PLOs
3.1	Evaluate and criticize the obtained report and effectively prepare an assay/report and observations for certain case study.	C1,C2
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.	S6, C2, C3,C6

C. Course Content

Topics	Contact hours
Laser Principles 1. Theory of temporal and spatial coherence 2. Coherence Length and Spectral Line Width 3. The optical properties of Laser beam 4. Electromagnetic Modes in a Cavity 5. Theory of Laser Emission 6. Major Types of Lasers 7. Measuring Laser Power and Focusing Laser Energy	**8**
Optical and Thermal Response of Tissue to Laser Radiation 1. The Optical Response Of Tissue 2. Thermal Response Of Tissue 3. Interaction of Laser Light With Living Systems	**4**
Therapeutic and Diagnostic Application of Lasers in Ophthalmology 1. Basic Ocular Anatomy and Physiology and Transmission and Absorptive Properties of Ocular Tissues 2. Photothermal Laser Applications 3. Photodisruptive Laser Applications 4. Photochemical Laser Applications: Photoablation and Photodynamic Therapy	**6**
Diagnostic Laser Applications • Lasers in Ophthalmology. • Retina. • There exist six major indications for laser treatment of the retina: – retinal holes, – retinal detachment, – diabetic retinopathy, – central vein occlusion, – senile macula degeneration, – retinal tumors (retinoblastoma). • Vitreous Body.	

• Lens
  ○ Posterior capsulotomy.
• Iris.
  ○ laser iridotomy.
• Trabeculum.
  Laser Trabeculotomy.
• Cornea:
  ○ Cornea structure.
  ○ Radial keratotomy.
  ○ Radial keratectomy (RK).
  ○ keratomileusis or photorefractive keratectomy (PRK)
  ○ Calculation of Theoretical values of keratomileusis in the case of myopia
• Laser in situ keratomileusis (LASIK).
  ○ LASIK treatment with a Nd:Glass femtosecond laser.
• Lasers in Dentistry.
	10

Laser Safety	**2**
❖ **Lasers in Ophthalmology**	**30 hr**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize facts, principle and concepts of laser science and its medical applications.	1.Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, multimedia 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	Solve some example during the lecture. Exams: a) Quizzes (E-learning) b) Short exams (mid-term exams) c) Long exams (final) d) Discussions during the lectures.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.2	Applying basic information to the use of laser in medicine such as ophthalmology, dentistry, Cosmology.	1. Applying the principles to realistic physics problems. 2. Show the best ways to solve the problems 3. Show the best ways to demonstrate the results. 4. Discussion with the student about the results.	Home work. Discussing during the class.
…			
2.0	**Skills**		
2.1	Solve problems in physics by using suitable Laser scientific principles and facts.	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem.	1.Midterm's exam. Exams, short quizzes 2.Asking about methods previously taught 3.Discussions of how to simplify or analyze some phenomena.
2.2	Acquire the skills to use the internet communicates tools.		
2.3	Show responsibility for self-learning to be aware with recent developments in physics		
2.4	Work effectively in groups as well as individual.		
3.0	**Competence**		
3.1	Evaluate and criticize the obtained report and effectively prepare an assay/report and observations for certain case study.		
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.		
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	6 &14	40 %
3	Mid Term Exam (practical)	--	--

#	Assessment task*	Week Due	Percentage of Total Assessment Score
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	--	--
5	Final Practical Exam	--	--
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Students are supervised by academic advisers in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1-Paul Davidovits "Physics in Biology and Medicine" 3rd edi. Elsevier 2008. 2-Russell K. Hobbie & Bradley J. Roth "Intermediate Physics for Medicine and Biology" Springer Science 2007. 3- Raymond A. Serway - John W. Jewett "Physics for Scientists and Engineers" Thomson Brooks 2004. 4-John R. Cameron & James G. Skofronick "Medical physics" Willy John 1988
Essential References Materials	
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Physics of Medical Ultrasound**
Course Code:	**4033290-2**
Program:	**Medical Physics Program**
Department:	**Department of Physics**
College:	**College of Applied Science**
Institution:	**Umm Al – Qura University**

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type	
a. University ☐ College ☐ Department [X] Others ☐	
b. Required [X] Elective ☐	
3. Level/year at which this course is offered: **Level 5/ Year 3**	
4. Pre-requisites for this course (if any)**: Fundamentals of Medical Physics (4032280-4)**	
5. Co-requisites for this course (if any)**: Not Applicable**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	25	83%
2	**Blended**	5	17%
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Quizzes, Homework, Class Test Exams, oral discussion)	30
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	32
Other Learning Hours		
1	**Study** (Private study)	45
2	**Assignments** (Quizzes and Homework Solving)	15
3	**Library**	3
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2
	Total	70

* The length of time that a learner takes to complete learning activities that lead to the achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The overall goal is to study the physical characteristics of ultrasound waves, generation methods and different medical applications as a safe medical imaging technique.

2. Course Main Objective

Upon completion of the course, the student should be able to:

1. Identify the basic fundamentals of ultrasound (US) waves: Physics of wave motion, ultrasound intensity, and attenuation of ultrasound.
2. Perform basic mathematical calculations related to US physics.
3. List and describe the components of a US transducer.
4. Comprehend transducer construction and how US waves are generated, detected and received by the transducer.
5. Differentiate between different types of ultrasound imaging modes (i.e., A mode, B mode, M-mode and 2D Echocardiography).
6. Describe the various functions performed by the transducer and how to manipulate them for the best image quality.
7. Describe the types of Doppler evaluation and identify the similarities and differences.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:** On successful completion of this course it is expected that students will be able to:	
1.1	Describe acoustic quantities and their relationships, namely: displacement, pressure, particle velocity, phase velocity, acoustic impedance, absorption, energy density and intensity	**K1**
1.2	Recognize the basic knowledge of ultrasound wave generation, detection, and receiving using transducer.	**K1 & K3**
1.3	List the basic modes of ultrasound imaging and outline the basic information about Doppler effect and its applications.	**K3**
1.4	Recognize how to assess, improve and develop the quality of medical ultrasound images.	**K6**
2	**Skills:** On successful completion of this course it is expected that students will be able to:	

CLOs		Aligned PLOs
2.1	Recognize and predict the fundamentals and functions of the medical ultrasound imaging field.	S1
2.2	Investigate the transducer structure, defects and problems, different types of ultrasound imaging modes in a field of study using a range of sources and draw valid conclusions.	S2 & S3 & K6
2.3	Demonstrate ICT to appraise and critically evaluate research relevant to advanced medical ultrasound imaging practice.	S2
2.4	Perform with supervision, a research project independently, including the formulation of the research question based on good general insight in the field, experimental design, implementation, and results analyses and reporting.	S5 & S6
3	**Competence:** On successful completion of this course it is expected that students will be able to:	
3.1	Employ the acquired knowledge for the analysis and assessment of the US machine main defects and error in the obtained images correlating causes.	**C1**
3.2	Apply his/her knowledge and capabilities to analyze and carry out research in the medical ultrasound imaging filed and in not-familiar domains.	**C2 & C4**
3.3	Carry out electronic research independently and knows how to formulate and express results and interpretations of the research outcomes.	**C3 &C4 & C6**
3.4	Use the capacity to critically reflect on personal and professional practice in order to identify potential areas of development and justify a short report in a written form and/or orally using appropriate scientific language.	**C5**

Program learning Outcomes*

Knowledge: ***Summary description of the knowledge to be acquired and on completing this program, students will be able to:***	
K1	Acquire the major aspects of nature and subject of medical physics and the application of physics to medicine.
K2	List matter in various forms, including crystals, semiconductors, atoms, nuclei and understand the principles of laser and its application in medicine.
K3	Recognize Bioinformatics in order to know how to analysis data which is used to diagnose with the aid of different medical devices such as X- ray machines, gamma camera, accelerator and nuclear magnetic resonance.
K4	Define different quantitative, mathematical science and physical tools analyze problems and list some foundations of systems theory to solve and analysis different problems.
K5	Recognize the nature, properties, dosimetery of radiation and basics of radiation protection and also medical effects of ionizing and non-ionizing radiation.
K6	Outline the principles of physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics.
Skills: ***Summary description of the skills to be acquired and on completing this program, students will be able to:***	
S1	Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in medical physics and related fields of studies.
S2	Formulate and test hypotheses using appropriate experimental design and analysis of data (Computer simulation) and integrate IT-based solutions into the user environment effectively.

S3	Analyze and evaluate information by using computational tools to interpret experimental data relevant to medical physics by using packages from different theoretical and experimental resources, and perspectives.
S4	Operate some medical instruments such as that used for the diagnosis of different diseases in medical centers and demonstrate competency in laboratory techniques and safety.
S5	Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.
S6	Justify ethical, social and legal responsibilities concerning medical physics.
S7	
Competence: ***Summary description of the Competence to be acquired and on completing this program, students will be able to:***	
C1	Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of medical physics issues.
C2	Demonstrate scientific concepts and analytical argument, in a clear and organized way, verbally and in writing.
C3	Implement all kinds of relevant information in medical physics through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.
C4	Work independently and demonstrate the ability to manage time and to work as a part of a team, and learn independently
C5	Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.
C6	Summarize, document, report, and reflect on own findings.

C. Course Content

No	List of Topics	Contact Hours
1	**Waves in Elastic Media** 1.1 General Definitions 1.2 kinds of mechanical waves • Longitudinal Wave • Transverse Wave 1.3 Physical Description of Both Longitudinal and Transverse Waves 1-Graphical representation of a longitudinal wave 2. Graphical representation of a transverse wave • The transverse wave displacement equation of the at any time and position • Description of transverse traveling wave 1.4 The propagation of sinusoidal wave through a string who has a mass per unit length (μ) and is under a tension (F)	**4**
2	**Ultrasound Waves** General Definitions 2.1	**8**

	Ultrasound (US) intensity 2.2 • Relation between Ultrasound intensity and maximum pressure (P_m) in the medium Solved problems 2.2 Acoustic Impedance 2.3 Attenuation of Ultrasound (US) (Absorption, Reflection and Scattering) 2.3.1- Specular Reflection & Transmission • The intensity reflection coefficient • The intensity transmission coefficient Solved problems 2.3.2 – Scattering 2.3.3 – Absorption 2.4. Overall Attenuation definitions and equations 2.5. Intensity at half value thickness definitions and equations 2.6 The logarithmic attenuation coefficients on frequency for some tissues	
3	**Generating and Detecting of Ultrasound** **3**.1 The Piezoelectric Effect: Naturally occurring crystalline materials .1 Artificial materials .2 What is a crystal? .3 3.2 Generating of Ultrasound (US) 3.3 Detecting of US 3.4 Detecting or receiving of US 3.5 Transducer Design 3.6 Resonance Frequency 3.7 Ultrasound (US) For medical applications	**6**
4	**Us Presentation Modes** 1-A-Mode 2-B-Mode B-mode images may be displayed as either “static” or “real-time” images Real-time B-mode images are useful in 3-The M-mode 2D Echocardiography The time required to obtain images Pulse Repetition Period (PRP) Image Frame Rate and Spatial Sampling Transducer selection	**8**

5	**The Doppler Effect** 1- Measurement of the frequency shift. 2- Measurement of reflection from media of different acoustic impedances.	4
	Total	**30**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Describe acoustic quantities and their relationships, namely: displacement, pressure, particle velocity, phase velocity, acoustic impedance, absorption, energy density and intensity	• Lectures • In-class discussions • Exercises • Open discussion • Internet search	• Graded homework. • Assignments. • Quizzes. • Oral Group Discussion. • Class Test Exam(s) • Final exam
1.2	Recognize the basic knowledge of ultrasound wave generation, detection, and receiving using transducer.		
1.3	List the basic modes of ultrasound imaging. Outline the basic information about Doppler effect and its applications.		
1.4	Recognize how to assess, improve and develop the quality of medical ultrasound images.		
2.0	**Skills**		
2.1	Recognize and predict the fundamentals and functions of the medical ultrasound imaging.	• Lectures. • Problem solving • Case study.	-Individual homework problems and assignment tasks - Group and individual assignment tasks - Students are encouraged to understand problems rather than just memorizing various problem types. - Performance in the class and on the exams
2.2	Investigate the transducer structure, defects and problems, different types of ultrasound imaging modes in a field of study using a range of sources and draw valid conclusions.	• Lectures • Problem solving • Small group work • Open discussion • Internet search	
2.3	Demonstrate ICT to appraise and critically evaluate research relevant to advanced medical ultrasound imaging practice.	• Lectures • An awareness of time management in completing their reports. • Encourage students to help each other	

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• Group assignments	
2.4	Perform with supervision, a research project independently, including the formulation of the research question based on good general insight in the field, experimental design, implementation, and results analyses and reporting.		
3.0	**Competence**		
3.1	Employ the acquired knowledge for the analysis and assessment of the US machine main defects and error in the obtained images correlating causes.	• Directing the student to self-learning and a greater knowledge in the field of course • Tutorial Classes. • Encourage students to think critically and involve in discussions with the instructor in the classroom. • Oral presentations on related topics will be held in class weekly • Work independently and as part of a team. • Encourage peer discussion and offer one to one discussion • Building up a friendly relationship between instructor and students, so that students can understand more on the subject • Giving consultation	• Assessments of student's assignments. • Evaluation of group reports and individual contribution within the group. • Reports and presentations. • Instructor's feedback • Final and short exams include different problems which need numerical and technical skills.
3.2	Apply his/her knowledge and capabilities to analyze and carry out research in the medical ultrasound imaging filed and in not-familiar domains.		
3.3	Carry out electronic research independently and knows how to formulate and express results and interpretations of the research outcomes.		
3.4	Use the capacity to critically reflect on personal and professional practice in order to identify potential areas of development and justify a short report in a written form and/or orally using appropriate scientific language.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	5 %
2	Class Test Exam (Two Written Tests)	6 &14	40 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	3-16	5 %
5	Final Practical Exam	--	--

#	Assessment task*	Week Due	Percentage of Total Assessment Score
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Faculty members dedicate 6 hours at least every week for office hours, during which students are encouraged to visit their instructor for help, conversation practice and clarifying difficult concepts. The Academic Management Unit also supervises a Student Support Committee that provides additional tutoring and help to weaker students or students who were registered late by the university. There is also a Special Educational Needs coordinator who helps students with special needs.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt Jr, and John M. Boone, The Essential Physics of Medical Imaging, Lippincott Williams & Wilkins, A Wolters Kluwer, 3rd Ed, 2012. 2. Medical Imaging Physics Fourth Edition, William R. Hendee, E. Russell Ritenour, Wiley-liss, Inc., New York, 2002. 3. Diagnostic Ultrasound, Second Edition, Peter Hoskins Ba, Cambridge University Press, 2010.
Essential References Materials	1. Physics Of The Human Body, Irving P. Herman, Springer-verlag Berlin Heidelberg 2007. 2. Physics of The Life Sciences, Jay Newman, Springer Science+business Media, Llc, 2008. 3. Introduction to The Physics of Ultrasound, Pascal Laugier And Guillaume Ha¨ıat, Springer Science+business Media B.V. 2011. 4. Fundamentals of Ultrasonographic Techniques By: J.D. Wicks And K.S. Howe 5. Basic Physics And Technology Of Medical Diagnostic Ultrasound By: M. Hussey.

Electronic Materials	https://www.journals.elsevier.com/medical-image-analysis/ http://obgyn.onlinelibrary.wiley.com/hub/journal/10.1002/(ISSN)1469-0705/
Other Learning Materials	1- Free Software from the Medical Imaging Group http://mi.eng.cam.ac.uk/~rwp/Software.html 2- Ultrasound Imaging https://www.class-central.com/tag/ultrasound%20imaging 3. The Microsoft Office for editing reports. 4. The Matlab and Image J software package to train the student about how making image processing

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• There are enough classrooms provided with a good accommodation, including good air condition, good data show slide projector, and suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show slides, Overhead projector, whiteboard, course book software, internet, speakers, printers, photocopiers, and laptops for teachers. • E-learning 2DL system. • Student correspondence system.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Not applicable (as the course doesn't have a laboratory section.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement, of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Level Six

Radiation Medical Physics (2) 4033292-4

Nuclear Physics (1) 4034160-4

Solid State Physics (1) 4034170-4

Electromagnetism (1) 4033132-3

Health Physics 4033283-3

COURSE SPECIFICATION

Course Title:	**Medical Radiation Physics (2)**
Course Code:	**4033292-4**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Science**
Institution:	**Umm AL – Qura University**

Table of Contents

A. Course Identification

1. **Credit hours:** (3+1+0) Hrs			
2. Course type			
a. University ☐	College ☐	Department √	Others ☐
b. Required √	Elective ☐		
3. Level/year at which this course is offered: Level 6/ second term -3rd year			
4. Pre-requisites for this course (if any)**:** Medical Radiation Physics 1 (4033285-4)			
5. Co-requisites for this course (if any)**:**			

6. Mode of Instruction (mark all that apply

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom (including Laboratory classroom)	40+39=79	90.8%
2	Blended	8	9.2%
3	E-learning	-	-
4	Correspondence	-	-
5-	Other	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	**Laboratory/Studio**	42
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	89
Other Learning Hours*		
1	**Study** (Private study including the laboratory hours)	110
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	20
3	**Library**	20
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2

Total	**157**

The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

This course is interested in studying the natural back ground radiation and medical sources, Conventional x-ray dosimetry, Computed tomogram dosimetry, mammogram dosimetry and nuclear medicine dosimetry. In addition to study the concept and measurement of ambient dose equivalent, directional dose equivalent and personnal equivalent . it interested in managing radioactive contamination , decontamination factor and assessment of skin dose due to decontamination .

What is the main purpose for this course?

At the end of this course the students will be able to:

1- **Acquire** basics of exposures by cosmic radiation and cosmogenic radionuclides, origin and Factors affecting on exposure to cosmic radiation ,Internal exposures to human from terrestrial radiations.
2.List the Reference Dose level (RDLs) in diagnostic Radiology, conventional x-ray and CT.
3-Acquire the basic of the radiation protection quantities and units, and operational quantities.
4-**Calculate** the entrance skin dose for patients undergoing diagnostic X-ray.
5-Describe types of phantoms of the human body.
6- Acquire information about occupational exposures and Environmental source geometries
7- **Acquire** different methods for external dosimetry.
8- **List** the différents route of radionucléides intime.
9-Calculate the internal dose using Médical Internal Radiation Dose, MIRD method.
10- Acquire procedure of direct measurement of internal dosimetry.
11- **Describe** the methods for decontamination.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Outlines about natural background radiation and other sources.	K2
1.2	*List the RDLs for conventional x-ray, CT, Mammogram*	K2
1.3	*Describe calibration of thermoluminscence dosimeters*	K5

CLOs		Aligned PLOs
1.4	State operational radiation quantities	K4
1.5	Memorize protection radiation quantities	K4
1.6	Describe different methods of medical internal dosimetry	K5
1.7	State fundamentals of Decontamination concept and reduction factor	K4
1.8	Memorize the importance of Skin equivalent dose calculation	K5
2	**Skills:**	
2.1	Evaluating the internal effective dosses for organs in nuclear medicine and related fields of studies.	S1 and S3
2.2	Applying the mathematical expressions in calculating the external and internal doses due to external and internal exposure.	S1
2.3	Integrate information technology (IT) based solution into radiation.	S2
3	**Competence:**	
3.1	Appraise the cooperation through teamwork to make a decision.	C3
3.2	The student knows how to analyse obtained data and how to manage it.-	C4
3.3	Knowledge and capability of students to use computers and internet.	C3
3.4	Justify a short report in a written form and perform effective communication with colleagues and faculty members.	C6
3.5	Appraise the the ability of students to use programs designed for medical internal radiation dose software and enhancing their ability to interpret the results.	C1

Program learning Outcomes*

Knowledge: ***Summary description of the knowledge to be acquired and on completing this program, students will be able to:***	
K1	Acquire the major aspects of nature and subject of medical physics and the application of physics to medicine.
K2	List matter in various forms, including crystals, semiconductors, atoms, nuclei and understand the principles of laser and its application in medicine.
K3	Recognize Bioinformatics in order to know how to analysis data which is used to diagnose with the aid of different medical devices such as X- ray machines, gamma camera, accelerator and nuclear magnetic resonance.
K4	Define different quantitative, mathematical science and physical tools analyze problems and list some foundations of systems theory to solve and analysis different problems.
K5	Recognize the nature, properties, dosimetery of radiation and basics of radiation protection and also medical effects of ionizing and non-ionizing radiation.
K6	Outline the principles of physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics.
Skills: ***Summary description of the skills to be acquired and on completing this program, students will be able to:***	

S1	Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in medical physics and related fields of studies.
S2	Formulate and test hypotheses using appropriate experimental design and analysis of data (Computer simulation) and integrate IT-based solutions into the user environment effectively.
S3	Analyze and evaluate information by using computational tools to interpret experimental data relevant to medical physics by using packages from different theoretical and experimental resources, and perspectives.
S4	Operate some medical instruments such as that used for the diagnosis of different diseases in medical centers and demonstrate competency in laboratory techniques and safety.
S5	Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.
S6	Justify ethical, social and legal responsibilities concerning medical physics.
S7	
Competence: ***Summary description of the Competence to be acquired and on completing this program, students will be able to:***	
C1	Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of medical physics issues.
C2	Demonstrate scientific concepts and analytical argument, in a clear and organized way, verbally and in writing.
C3	Implement all kinds of relevant information in medical physics through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.
C4	Work independently and demonstrate the ability to manage time and to work as a part of a team, and learn independently
C5	Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.
C6	Summarize, document, report, and reflect on own findings.

C. Course Content

No	List of Topics	Contact Hours
1	**Part A Exposures from natural and man-made radiation sources** Exposures by cosmic radiation and cosmogenic radionuclides Origin and kinds of cosmic radiation Exposures by cosmic radiations Terrestrial radiation External exposures Internal exposures Man made sourses Defination of Reference Dose level, RDLs, List the RDLs level in diagnostic x-ray, computed tomogram and mammogram.	9

2	**Part B: External dosimetry.** Introduction • Protection and operational quantities **Protection quantities** *The basic Dosimetric Quantities* • *Absorbed dose* • *Protection Quantities* • *Mean Absorbed Dose* • *Equivalent Dose* • *effective dose* • ***Operational Quantities*** • *Ambient Dose Equivalent* • *Directional Dose Equivalent* • *Personal Dose Equivalents* • *Relationship between Qauntities for Radiological Protection and Monitoring Purpose* Dosimetric models **Models and phantoms of the human body** characteristics of phantom diagnostic phantoms, PMMA Phantom, Personal calibration phantoms, slab, chest and finger phantom Idealized geometries representing occupational exposures Environmental source geometries Calculating protection quantities in computational models	12
3	Part C Patients dosimetry Incidence Air Kerma Entrance Surface Air Kerma X-ray tube output Dose length product Computer tomogram Dose Index Direct and indirect dose assessment for patients underging diagnostic x-ray and computed tomogram.	9
4	**Part D- Medical Internal Radiation Dose** Absorption through intact skin , Systemic behaviour of radionuclides, Excretion, Calculation of Radiation Dose (MIRD METHOD) Cumulative activity Equilibrium absorbed dose constant Absorbed Fraction Mean Dose per Cumulative Activity	12

	Mean Dose per Cumulative Activity Whole Body Dose and Effective Dose W hole Body Dose and Effective Dose Patient dosimetry in diagnostic X-ray	
5	Part **E** Methods of individual monitoring Definition of decontamination, decontamination factor, skin dose Calculation.	3
Total		45

Practical part:

1.Safety Procedures in the lab.

Acceptance test for Diagnostic X-ray machine

2 .X-ray dose output reproducibility and inverse square law
3 Linearity of X-ray machine
4.. Kilovoltage and Time Accuracy

Radiation Dosimetry and dose reduction

5.Calibration of an eye lens dosimeter in terms of an equivalent dose
6. Measurements the surface radiotherapy dose for hands, face and nose
7. Absorbed doses to some phantoms organs
8, Dose minimization to pelvic during abdomen X-ray exposure .
9. Chemical dosimetry

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Outlines about natural background radiation and other sources.	Start each chapter by general idea of the meaning of exposure	1.Home work Interactive 2.discussion 3.Short exam1 4.Short exam2 Final exam
1.2	*List the RDLs for concentional x-ray, CT, Mammogram*		1.Presentations 2.Quizzes 3.. Problem solving

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.3	*Describe calibration of thermoluminscence dosimeters*	Demonstrate the course information and principles through lectures.	1 Oral questions 2.Presentations 3. .Quizzes 4.. Problem solving
1.4	State operational radiation quantities	Describing radiation protection concepts with solving problems Describing the procedure of Calculation the internal dose using Médical Interna Radiation Dose, MIRD method.	1. Oral questions 2. Presentations 3 .Quizzes 4. Problem solving
1.5	Memorize protection radiation quantities		
1.6	Describe different methods of medical internal dosimetry		
1.7	State fundamentals of Decontamination concept and reduction factor		
1.8	Memorize the importance of Skin equivalent dose calculation		
2.0	**Skills**		
2.1	Evaluating the internal effective dosses for organs in nuclear medicine and related fields of studies.	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.	Brain storming	Quiz and exams Discussions after the lecture
2.3	Integrate information technology (IT) based solution into radiation.	Discussion	*Quiz and exams* Discussions after the lecture
3.0	**Competence**		
3.1	work effectively in a group to make a decision.	Lab work -	Evaluate the efforts of each student in preparing the report. Evaluation of students presentations
3.2	Analyse obtained data and how to manage it. -	- Lab work -	Evaluate the scientific values of reports.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			Evaluate the work in team
3.3	Make a certain decision fast, especially during data acquisition.	- Case Study - Active learning	Evaluation of the role of each student in lab group assignment.
3.4	Enhancing the ability of students to use computers and internet.	*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
3.5	Know how to write a report Perform effective communication with colleagues and faculty members	*Seminars presentation*	Evaluate the scientific values of reports. Evaluate the work in team.
3.6	Enhancing the ability of students to use programs designed for medical internal radiation dose software and enhancing their ability to interpret the results. Know how to write a report	Field visits to hospitals	**Communication, Information Technology, Numerical**

2. Assessment Tasks for Students 2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	7-8 & 13-14	20 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	11	10 %
5	Final Practical Exam	15	10%
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each student will supervise by an academic adviser in physics Department and the time table for academic advice were given to the student each semester. (2 hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. Simon Cherry, Michael E. Phelps "Physics in Nuclear Medicine" 3rd add," Saunders 2003 2. Diagnostic Radiology Physics: A handbook for teachers and students , IAEA, 2014 3. Larry A. DeWerd Michael Kissick. The Phantoms of Medical and Health Physics. Springer Science+Business Media New York 2014 Edward .L .Alpen. , Radiation Biophysics. Second edition, 1998.
Essential	2.Ervin B. Podgorsak "Radiation physics for medical physicists" Springer 2006.
Electronic Materials	ICRP web sities go to http:// ICRP.org/publications.asp ICRP dose coefficients: computational development and current status https://www.pub.iaea.org/MTCD/publications/PDF/eprmedt/Day_1/Day_1-1.pps https://www.youtube.com/watch?v=f5ptI6Pi3GA.
Other Learning Materials	ANNEX E: UNSCAR, 2000. ANNEX B Exposures from natural radiation sources Occupational Radiation Sources

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• The area of class room is suitable concerning the number of enrolled students (68) and air conditioned.

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	roviding class rooms with computers and labs with data /.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom • Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Nuclear Physics**
Course Code:	**4034160-4**
Program:	**B.Sc Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm AL-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:							
2. Course type							
a.	University ☐	College ☐	Department √	Others ☐			
b.	Required √	Elective ☐					
3. Level/year at which this course is offered:							
4. Pre-requisites for this course (if any)**:** **QUANTUM MECHANICS (1)**							
5. Co-requisites for this course (if any)**:** **Not applicable (N. A)**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom (including Laboratory classroom)	41+40=93	93.1%
2	Blended	6	6.9%
3	E-learning	-	-
4	Correspondence	-	-
5	Other	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	**Laboratory/Studio**	42
3	**Tutorial**	-
4	**Others** (specify)	
	Total	87
Other Learning Hours*		
1	**Study**	75
2	**Assignments**	15
3	**Library**	4
4	**Projects/Research Essays/Theses**	3
5	**Others** (specify)	-
	Total	97

* The length of time that a learner takes to complete learning activities that lead to the achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will be cover the principle of nuclear physics, such as nuclear properties of the matter, Liquid drop and shell model, radiation. This also will be providng a conceptual and experimental background in the nuclear physics sufficient to enable students to take courses that are more advanced in related fields.

2. Course Main Objective

The objectives of this course are to establish the meaning of the concepts of nuclear physics and elementary particles, and to ease out the theoretical models to describe the nuclear properties.

We want to be able:

The benchmark statement of the main learning outcomes are as follows:

1. To understand basic fundamentals of nuclear properties.
2. The students should be trained on physical and generic skills (knowledge – cognitive – interpersonal – communication – problem solving – IT)
3. To understand the liquid drop model.
4. To understand the nuclear drop model.
5. To understand the origin of alpha transition within the nucleus.
6. To understand the origin of Gamma transition within the nucleus.
7. To understand the origin of Beta transition within the nucleus.
8. To understand the elementary particles.

The overall goal is to understand the fundamentals of nuclear physics.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:** On successful completion of this course it is expected that students will be able to:	
1.1	Demonstrate the basic fundamentals of nuclear properties.	K1

	CLOs	Aligned PLOs
1.2	Associate the quantum mechanics concepts to a proper understanding of nuclear physics phenomena proficiently.	K2
1.3		K3
1.4	Sketch the variation of binding energy per nucleon with nucleon number and define half-life and use the term to solve problems which might involve information in tables or decay curves.	K2,K3
1.5	Explain the relevance of binding energy per nucleon to nuclear fusion and to nuclear fission.	K3
2	**Skills:** On successful completion of this course it is expected that students will be able to:	
2.1	Determine nuclear properties such as binding energy, spin and parity in the framework of the liquid drop model and the shell model of the nucleus.	S1
2.2	State the key ideas of the Standard Models of nuclear physics, and name some current unsolved problems in nuclear physics.	
2.3	Explore physical phenomena by setting up experiments using a variety of laboratory instruments, collecting and analyzing data, and interpreting their results.	S2
2.4	Explain methods used to extract information about nuclei and particles through scattering experiments, and be able to derive quantitative information through calculations for simple cases.	S3
2.5	Acquire personal skills such as the ability to work both independently and in a group and argue with a scientific thinking behaviour.	S1
2.6	Be able to self-learning, analysis and synthesis of data and information using the necessary technology (e.g. ICT and software writing package).	S3
3	**Competence:** On successful completion of this course it is expected that students will be able to:	
3.1	Apply the scientific method to design, execute, and analyze a physical problem or an experiment.	C1
3.2	Prepare scientific research in a high quality form and introduce a report about certain scientific issue individually or participating with other students.	C2

CLOs		Aligned PLOs
3.3	Investigate the ability to identify the potential ethical issues in work-related situations; appreciation of intellectual property, environmental and sustainability issues; and promoting safe learning and working environment.	C3

C. Course Content

No	List of Topics	Contact Hours
1	**1- Nuclear Properties** Definitions & Nuclear radii Nuclear Mass-Binding Energy Nuclear Radiation, Energy levels. Nuclear Isomers. Angular Momentum, Parity and Symmetry Dipole moment, qudropole moment	6
2	**2- Liquid Drop Model** Binding Energy Sem-emperical Formula Mass Spectrometer Nuclear Reactions and Q-value	6 7
3	**3- Nuclear Shell Model** Single Particle model with square well and Harmocia Oscillator Magic Numbers Spin for Different nuclei Excited rootes nuclear magnetic moments Parity Isotopic spin	6
4	**4- Gamma Transitions** Multiple Moments Decay Constants Selection Nucles Angular Correlation Internal Conversion	
		6

5	**5- Alpha Transitions** Heavy Ions-Stabitlity Decay Constants Tunnel Effect Energy Levels	
6	**6- Beta Transitions** Theorgy of B-decay Allowed and Forbiddin transitions Selection Nucles Non Conservation of Parity	6
7	**7- Elementary Particles** Nucler Force and Meson Theory Pions & Mions Kaons & Hyperons Classi Fiction of demeray Pancles	9
Total		45

Laboratory experiments

No	List of Topics	Contact Hours
1	Theoretical Background and Review	6
2	Operating Plateau for the Geiger Tube	3
3	Half-Life Determination	3
4	Determining the half-life of Ba−137	3
5	Absorption Coefficient of Beta particles	3
6	Absorption Coefficient of Gamma Rays	3
7	Resolution time of Gm counter	3
8	Attenuation of Gamma rays by matter	3
9	Inverse Square Law	3
10	Counting Statistics	3
11	The Efficiency of a G-M Counter	3
12	Deflection of Beta Particles in a Magnetic Field	3
13	Gamma Ray spectroscopy Using a Scintillation Detector	3
Total		42

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Demonstrate the basic fundamentals of nuclear properties.	Demonstrating the basic information and principles through lectures. Lecturing method: Board,(b) Power point. Discussions Brain storming. Start each chapter by general idea and the benefit of it.	1.Quizzes, midterm, and final exams. Homeworks
1.2	Associate the quantum mechanics concepts to a proper understanding of nuclear physics phenomena proficiently.	Demonstrating the basic information and principles through lectures. Lecturing method: Board, Power point. Discussions Brain storming.	1. Quizzes, midterm, and final exams. .Homework.
1.3	Sketch the variation of binding energy per nucleon with nucleon number and define half-life and use the term to solve problems which might involve information in tables or decay curves.	Demonstrating the basic information and principles through lectures. Lecturing method: Board, Power point. Discussions Brain storming.	1. Quizzes, midterm, and final exams. .Homework.
1.4	Explain the relevance of binding energy per nucleon to nuclear fusion and to nuclear fission.	Demonstrating the basic information and principles through lectures. Lecturing method: Board, Power point. Discussions Brain storming.	1. Quizzes, midterm, and final exams. .Homework.
2.0	**Skills**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.1	Determine nuclear properties such as binding energy, spin and parity in the framework of the liquid drop model and the shell model of the nucleus.	1. Following some proofs. 2. Define duties for each chapter. 3. Homework assignments. Encourage the student to look for the information in different references	1. Exams 2. Short quizzes. 3. Team work projects. Solving problems.
2.2	State the key ideas of the Standard Models of nuclear physics, and name some current unsolved problems in nuclear physics.	1. Group discussions. 2. Discussions Brain storming.	1. Exams 2. Short quizzes. 3. Asking about physical laws previously taught. 4. Team work projects. Solving problems
2.3	Explore physical phenomena by setting up experiments using a variety of laboratory instruments, collecting and analyzing data, and interpreting their results.	1. Demonstrating the basic information and principles through lectures. 2. Lecturing method: Board, Power point. 3. Discussions Brain storming.	1. Quizzes, midterm, and final exams. .Homework.
2.4	Explain methods used to extract information about nuclei and particles through scattering experiments, and be able to derive quantitative information through calculations for simple cases.	1. Group discussions. 2. Lecturing method: Board, Power point 3. Discussions Brain storming.	5. Exams 6. Short quizzes. 7. Asking about physical laws previously taught. 8. Team work projects. 9. Solving problems
2.5	Acquire personal skills such as the ability to work both independently and in a group and argue with a scientific thinking behaviour.	1. Group discussions. 2. Lecturing method: Board, Power point 3. Discussions Brain storming.	1. Discussion. 2. Homework. Reports.
2.6	Be able to self-learning, analysis and synthesis of data and information using the necessary technology (e.g. ICT and software writing package).	1. Group discussions. 2. Lecturing method: Board, Power point 3. Discussions Brain storming	3. Discussion. 4. Homework. Reports.
3.0	**Competence**		
3.1	Apply the scientific method to design, execute, and analyze a physical problem or an experiment.	1. Group discussion. 2. Cooperative learning. 3. Solving problems.	5. Discussion. 6. Homework. Reports.
3.2	Prepare scientific research in a high quality form and introduce a report about certain scientific issue individually or participating with other students.	1. Computational analysis. 2. Data representation. Focusing on some real results and its physical meaning.	1. Results of computations and analysis. 2. Homework.
3.3	Investigate the ability to identify the potential ethical issues in work-related situations;	1. Group discussion. 2. Cooperative learning.	1. Reports. 2. Projects

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	appreciation of intellectual property, environmental and sustainability issues; and promoting safe learning and working environment.	3. Solving problems	.

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	5 &13	20 %
3	Lab. reports	Weekly	10 %
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	--	--
5	Final Practical Exam	10	10%
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : 2 office hours per week

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	K. Heyde, Basic ideas and concepts in nuclear Physics, An introductory approach, second edition, Institute of physics publishing, Bristol and Philadelphia (1999) ISBN 0 7503-0534 7 hbk, 07503 0535 pbk. Irving Kaplan, Nuclear Physics, Second Edition, Addison-Wesley Publishing Company (1977). Kenneth S. Krane , Introductory nuclear Physics, , first edition, Jone Wily & Sons Inc. (1988) ISBN 0 - 471-80553-X . * Burcham, Nuclear and Particle Physics, 2 Edition, Longman Publisher (1995),ISBN-10 : 0582 450888 , -13: 978 - 0582 4508882

Essential References Materials	(Journals, Reports, etc.)
Electronic Materials	Web Sites
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Lecture room for 40 students, with data show. • Library
Technology Resources (AV, data show, Smart Board, software, etc.)	• (AV, data show, Smart Board, software, etc.) • data show + Board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	(NA)

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Physics Department, Faculty of Applied Science, Umm Al-Qura University
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Solid State Physics 1**
Course Code:	**4034170-4**
Program:	**B.Sc. Medical Physics**
MDepartment:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:			
2. Course type			
a. University ✓	College ☐	Department ☐	Others ☐
b. Required ✓	Elective ☐		
3. Level/year at which this course is offered: Level 7/4st Year			
4. Pre-requisites for this course (if any)**:** Quantum Mechanics 1 (code : 4033145-4)			
5. Co-requisites for this course (if any)**:**			

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	60
2	Laboratory/Studio	
3	Tutorial	
4	Exams & Quizzes	8
	Total	68
Other Learning Hours*		
1	Study	107
2	Assignments	15
3	Library	
4	Projects/Research Essays/Theses	
5	Exams & Quizzes	20
	Total	142

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover An introduction to the physics governing the different types of binding in solid state materials, Geometry of Solids and crystalline state of matter, Reciprocal Lattice, Brillouin zone, Modern theories describing lattice vibrations, Energy bands, X-Ray Diffraction, Electrons in solids, and Optical properties of solid materials. Free electron theory in metals, band theory, thermal properties of solid materials.

2. Course Main Objectives

After completing this course student should be able to:

1. Define the principles and concepts of solid state physics.
2. Compare the origin of bonding in materials
3. Define the lattice planes & directions.
4. Explain the different types of defects in solid state and understand how it affect the physical properties of matter.
5. Explain how X-Rays Diffraction can be used in studying the solid structure.
6. Define phonons in crystals and distinguish between their different modes
7. Choose the right formulas to calculate specific heat & thermal conductivity of the lattice.
8. Recognize the main drawbacks of the free electron model in metals.
9. Identify: Bloch's theorem, Brillouin zones & Fermi surface in metals.
10. Classify different types of solid according to The Band Theory.
11. Distinguish between intrinsic & extrinsic Semiconductors and know their properties and applications.
12. Recognize the idea behind the Superconductivity phenomenon and be aware of its applications.

3.Course Learning Outcomes

	CLOs	AlignedPLOs
1	**Knowledge:**	
1.1	Recognize the atomic theory and the Binding Forces	**K1, I**
1.2	Recognize the crystal structure and the properties	**K1, I**
1.3	Recognize the structural defects in crystals	**K1, I**
1.4	Investigate the X-Rays Diffraction in crystals	**K3, P**
1.5	Describe the lattice vibrations	**K2, I**
1.6	Describe the free electrons in metals	**K2, I**
1.7	Describe the band theory in the solids	**K2, I**
1.8	Describe the thermal properties of solid materials	**K2, I**
2	**Skills:**	
2.1	Differentiate between the different types of binding in solid materials.	**S1, I**

CLOs		AlignedPLOs
2.2	Describe the different types of crystal structure	**S2, I**
2.3	Analyse the electrical and thermal conductivity in Metals	**S2, P**
2.4	Interpret the band theory in solids and Explain methods of measurement and assessment of properties of solids.	**S2, M**
3	**Competence:**	
3.1	Communicate effectively in oral and written form.	**C1,M**
3.2	Collect and classify the material for the course.	**C2,M**
3.3	Use basic physics terminology in English	**C1,M**
3.4	Acquire the skills to use the internet communicates tools.	**C2,M**

C. Course Content

No	List of Topics	Contact Hours
1	❖ **The atomic Theory and Binding Forces** 15- Review of atomic structure 16- Atomic binding and band theory 17- Binding forces between atoms 18- Lattice Energy Calculations 19- Types of bonds 20- Nucleation and growth kinetic 21- Experimental methods of crystal growth	**6**
2	❖ **Crystal Structure** 21- Long range and short rang order 22- The crystalline state 23- Basic definitions of crystallography 24- The seven crystal systems 25- Wigner Seitz primitive cell 26- Symmetry elements of crystals 27- Important plane systems in a cubic crystals 28- Miller's indices for crystal planes	**6**
3	❖ **Crystal Properties** 16- Crystal Directions and distance between crystal plans 17- Zone , Zone Axis and angles between zones 18- Atomic structure of crystals 19- Cubic and hexagonal close-packed 20- Characteristic of FCC and BCC structure 21- The crystal structure of some simple crystals	**6**
4	❖ **Structural Defects in Crystals** 6- Point defects and Free energy of a crystal	**4**

	7- Point defects in ionic crystals 8- Line defects and types of dislocation 9- Planer defects 10- Determination of vacancies concentration and the activation energy	
5	❖ **X-Rays Diffraction in Crystals** 11- Used rays in studying crystal structure 12- Generation and properties of X-rays 13- X-Rays scattering from an atom 14- X-Rays scattering from a crystal and Reciprocal lattice	**6**
6	❖ **Lattice Vibrations** 11. Elastic waves 12. Modes of vibrations and density of states of a continuous medium 13. The phonon 14. Elastic and non-elastic scattering 15. Lattice waves of one-atomic linear chain 16. Vibration Modes of 1D diatomic	**4**
7	❖ **Free electrons in metals** 15. The Electrical Conductivity in Metals 16. The Specific Resistance in Metals 17. The Electrical and Thermal Conductivity in Metals 18. The Quantum Theory in Free Electrons 19. Ground State Property of Free Electrons 20. Electronic Specific Heat of Metals 21. Some Problems in Free Electron Model	**8**
88	❖ **Band theory in the solids** 1. Origin of the Bands in Solid 2. Periodic Potential 3. Bloch Function 4. Crystal Structure in One-Dimensional Atomic Chain 5. Brillouin Zones 6. Band Theory in Free Electron Model 7. Density of States 8. The Effective Mass 9. Concept of Holes 10. Fermi Surfaces	**8**
9	❖ **Thermal properties of solid materials** 1. Specific heat: 2. Einstein model for specific heat, 3. Debye model for specific heat, 4. Heat capacity of solid body, 5. Heat capacity of electron gas, 6. Thermal conductivity of solid body, 7. Thermal expansion	**12**

Total	**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Recognize the atomic theory and the Binding Forces	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	1. Solve some example during the lecture. 2. Homework. 3. Discussions during the lectures. 4.Exams: a) Quizzes b) Short exams (mid-term exams) c) Long exams (final) d) Oral exams
1.2	Recognize the crystal structure and the properties		
1.3	Recognize the structural defects in crystals		
1.4	Investigate the X-Rays Diffraction in crystals		
1.5	Describe the lattice vibrations		
1.6	Describe the free electrons in metals		
1.7	Describe the band theory in the solids		
1.8	Describe the thermal properties of solid materials		
2.0	**Skills**		
2.1	Differentiate between the different types of binding in solid materials.	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem	1.Midterm's exam. Exams, short quizzes 2.Asking about physical laws previously taught 3.Writing reports on selected parts of the course 4.Discussions of how to simplify or analyze some phenomena
2.2	Describe the different types of crystal structure		
2.3	Analyse the electrical and thermal conductivity in Metals		
2.4	Interpret the band theory in solids and Explain methods of measurement and assessment of properties of solids.		
3.0	**Competence**		
3.1	Communicate effectively in oral and written form.	1. Incorporating the use and utilization of computer, software, network and multimedia through courses 2. preparing a report on some topics related to	1. Evaluating the scientific reports. 2. Evaluating activities and homework
3.2	Collect and classify the material for the course.		
3.3	Use basic physics terminology in English.		
3.4	Acquire the skills to use the internet communicates tools.		

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
		the course depending on web sites	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Exercises & Home works	All weeks	5 %
2	Participation in activities lectures	All weeks	5 %
3	Written Test (1)	6th week	20%
4	Written Test (2)	11th week	20%
5	Final Exam (theoretical)	16th week	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will supervise by academic adviser in physics department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1- Charles Kittel, Introduction to Solid State Physics 7th Ed 2- Walter A. Harrison, Solid State Theory , Dover edition 1979
Essential References Materials	
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom for 40 students with data show Library
Technology Resources (AV, data show, Smart Board, software, etc.)	Computer room Data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Classroom data show, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
1. Following up the progress of students in the course.	instructor	Homework & quiz
2. Evaluating the progress of student	instructor	projects.
3. Evaluating the instructor.	student	questionnaires.
4. Revision of Exam paper	another staff member	Standers of the exam papers
5. Analysis the grades of students.	instructor	Gaussian distribution

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Electromagnetism 1**
Course Code:	**4033132-3**
Program:	**Physics**
Department:	**Physics department**
College:	**Applied science**
Institution:	**Umm AL – Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 3							
2. Course type							
a.	University	☐	College ☐	Department	√	Others	☐
b.	Required	√	Elective ☐				
3. Level/year at which this course is offered: 3^{rd} Year / Level 6							
4. Pre-requisites for this course (if any)**:** Classical Physics (403200-4)							
5. Co-requisites for this course (if any)**:**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	100%
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	
3	Tutorial	
4	**Others** (exam and quizzes)	8
	Total	
Other Learning Hours*		53
1	Study	65
2	Assignments	15
3	Library	
4	Projects/Research Essays/Theses	
5	**Others** (exam and quizzes)	20
	Total	153

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course deals primarily with a vector calculus based description of static electric field in case of fixed charges, volume and surface charge distribution, dipole, multipole, conductor and dielectric beside the calculation of the electrostatic potentials in each case. The calculation of the electric field by applying Gauss's law for fixed charges and dielectric materials. Also, it concerns the study of the polarization, dielectric constant and the boundary conditions at the interface at the two different dielectric media. The calculation of molecular fields, electrostatic energy and the description of moving charges and steady electric currents are also presented.

2. Course Main Objective

Describe, in words, the ways in which various concepts in electromagnetism come into play in particular situations; to represent these electromagnetic phenomena and fields mathematically in those situations; and to predict outcomes in other similar situations.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Define the quantity of electrostatic field and electric flux	K1
1.2	Describe the concepts and theoretical in the electrostatic	K2
1.3	Identify the new research and application	K3
1...		
2	**Skills:**	
2.1	Apply the theoretical laws and principles relevant to electrostatic	S1
2.2	Analyze the different formation and sources of electrostatic.	S2
2.3	Demonstrate a reasoned argument to simplify problems and analyze phenomena in electrostatic	S2
2-4	Critically assess, evaluate, explain the idea with the student own words, identify, formulate and solve the electrostatic represent the problems mathematically	S3
3	**Competence:**	
3.1	Plan, design, record, execute and communicate a piece of independent research in electrostatic	C1
3.2	Respond to the change of electromagnetic information and analyses electrostatic data	C2
3.3	Computation and problem solving	C3
3-4	Data analysis and interpretation and feeling physical reality of results	C2

C. Course Content

No	List of Topics	Contact Hours
1	❖ **Electrostatics:** 1-Electric Charge 2-Coulomb's law 3-The Electric Field 4-Electrostatic Potential 5-Conductors & Insulators 6-Gauss's Law 7-The Electric Dipole	6
2	❖ **Solution of electrostatic problems:** 1-Poisson's Equation 2-Laplace's Equation 3-Laplaces's Equation in one independent Variable 4-Laplace's Equation in Spherical Coordinates 5-Conducting Sphere in Uniform 6-Cylindrical Harmonics 7-Electrostatic Images 8-Point charge & Conducting Sphere 9-Line charges & Line Images 10-System of Conductors	**15**
3	❖ **The Electrostatic Field in Dielectric Media** 1-Polarization 2-Field Outside of a Dielectric Medium 3-The Electric Field inside a Dielectric 4-The Electric Displacement 5-Electric Susceptibility and Dielectric Constant 6-Point Charge in a Dielectric Field 7-Boundary Conditions on the Field Vector 8-Boundary Value Problem Involving Dielectrics	**9**
4	❖ **Electrostatic Energy** 1-Potential Energy of a Group of Point Charges 2-Energy Density of an Electrostatic Field 3-Energy of a System of Charged Conductors 4-Capacitors.	**6**
5	❖ **Electric Current**	**6**

	1-Current Density & Equation of Continuity 2-Ohm's Law 3-Steady Currents in continuous Media 4-Microscopic Theory of Conduction.	
...		
Total		**42**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define the quantity of electrostatic field and electric flux	* The methodology of teaching that includes a curriculumdesign, planning and delivering teaching and assessment, combination of lectures and web-interactions by the lecturer. These will give *The opportunity of students to understand the basic science of the electromagnetic and its different applications in life. *Effective by solve some examples during the lecture Small group teaching and assessment learning. *Teaching for reflective learning and research methods. *Seminar presentation and on-line learning process with (images and movies) *Collect the new information about what the new in electromagnetic	Periodical quizzes, assignments and homework First and second mid-term exam and final exam Emphasis of the students in the presence of the lecture continuously Making the students are working small projects and report for electromagnetically and its applications around us. Ask the student to clear the miss understanding of the course
1.2	Describe the concepts and theoretical in the electrostatic		
1-3	Identify the new research and application		
2.0	**Skills**		
2.1	Analyze the different formation and sources of electrostatic.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	Apply the theoretical laws and principles relevant to electrostatic	Preparing main outlines for teaching in the starting of the lecture Define tasks for each chapter Open discussions during the lectures Brain storming, group work, homework assignments and small project Encourage the student to look for the information in different sources	All exams and short quizzes . Asking the students about physical meaning and laws previously taught writing reports on selected parts of the course Discussions of how to simplify or analyses after the lecture
2-3	Demonstrate a reasoned argument to simplify problems and analyze phenomena in electrostatic		
3.0	**Competence**		
3.1	Plan, design, record, execute and communicate a piece of independent research in electrostatic	Learn how to search the internet and use the library Teamwork and small group discussion Interactive learning Homework (preparing a report on some topics related to the course depending on web sites). Seminars presentation	Quizzes Checking report and evaluate the efforts and scientific values of each student in preparing report. Their interaction with the lectures and discussions Evaluation of presentation Oral discussion
3.2	Respond to the change of electromagnetic information and analyses electrostatic data		
3-3	Computation and problem solving		
3-4	Data analysis and interpretation and feeling physical reality of results		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Exercises & Home works	All weeks	5 %
2	Participation in activities lectures	All weeks	5%

#	Assessment task*	Week Due	Percentage of Total Assessment Score
3	First Exam (theoretical)	7th week	20%
4	second Exam (theoretical)	13th week	20%
5	Final Exam (theoretical)	16th week	50%

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will be supervised by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (2 hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introduction to Electrodynamics by David J. Griffiths, [Prentice-Hall, Inc., 1999], 3rd Edition.
Essential References Materials	• Foundations of Electromagnetic Theory by Reitz, John R., Milford, Frederick J., Christy, Robert W. [Addison-Wesley, 2008] 4th Edition • Electromagnetic Fields and Waves by Paul Lorrain, Dale R. Corson, Francois Lorrain [W. H. Freeman and Company, 1988] 3rd Edition
Electronic Materials	https://www.khanacademy.org/science/physics
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.

Item	Resources
	There are enough laboratories for experimental physics, provided with air conditions, good data show, and experimental equipment.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Strategies for Obtaining Student Feedback on Effectiveness of Teaching	Student	• Course reports • Course evaluation.
Other Strategies for Evaluation of Teaching by the Instructor or by the Department	Program leader	• Revision of student answer paper by another staff member. • Analysis the grades of students.
Processes for Improvement of Teaching	Department	• Preparing the course as PPT. • Using scientific flash and movies. • Coupling the theoretical part with laboratory part • Periodical revision of course content.
Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample	Peer reviewers	• The instructors of the course are checking together and put a unique process of evaluation. • Check marking of a sample of papers by others in the department.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
of assignments with staff at another institution)		• Feedback evaluation of teaching from independent organization. • Independent evaluation by another instructor that give the same course in another faculty. • Evaluation by the accreditation committee in the university.
Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement	Program leaders and peer reviwers	1- The following points may help to get the course effectiveness • Student evaluation • Course report • Program report • Program Self study 2- According to point 1 the plan of improvement should be given.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Health Physics**
Course Code:	**4033283-3**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied sciences**
Institution:	**Umm-AL-Qura University**

Table of Contents

A. Course Identification

1. **Credit hours:** **3 (2+1+0) Hrs**	
2. **Course type**	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. **Level/year at which this course is offered:** **6th Level /3rd Year**	
4. **Pre-requisites for this course** (if any): **Radiation Medical physics (4033285-4)**	
5. **Co-requisites for this course** (if any): **NIL**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom (including Laboratory classroom)	39	86.6%
2	Blended	6	13.3%
3	E-learning	-	-
4	Correspondence	-	-
5	Other	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture (**Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	**Laboratory/Studio**	0
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	47
Other Learning Hours		
1	**Study** (Private study)	70
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	20
3	**Library**	10
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2
	Total	107

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

An introduction to the field of Health physics, which concetrates on the fundamentals of radiation and radiation protection; including types of ionizing and non-ionizing radiation, radioactive decays,interaction of radiation with matter, biological effects of exposure to low level radiation, radiation detection and measurement, radiation protection methods and techniques, and radioactive waste disposal. Lectures will include use of radiation and personal exposures in the categories of environmental radiation, medical applications, consumer products, industrial uses, research uses, and military uses, moreover, various types of sensors and measurement apparatus used for the calibration of medical imaging and therapy systems will receive particular attention

2. Course Main Objective

At the end of this course, the student should be able to:

- Establish the ubiquitous nature of radiation and the many technologies in his society which utilize radiation or radioactive materials.
- Provide the basic understanding of radiation and radioactive decay.
- Explain the biological effects of exposure to radiation.
- Demonstrate how radiation can be detected and dose measured
- Provide the basis for radiation protection and keeping exposure to As Low as Reasonable Achievable (ALRA).
- Provide a realistic perspective on the radioactive waste disposal.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:** On successful completion of this course it is expected that students will be able to:	
1.1	List source of radiation	K.1
1.2	Recognize occupational and public exposure limits in addition to the safety requirement	K.4
1.3	Outline the Different Types of Health Physics Instrumentations	K.2

	CLOs	Aligned PLOs
1.4	Recognize the Types of Radioactive Wastes and Environmental Monitoring Program	K.3,S.1
2	**Skills:**On successful completion of this course it is expected that students will be able to:	
2.1	The ability to explain the different types of radiation interactions with matter	K.1
2.2	The ability to analyze merits and drawbacks of different health physics instrumentations	K.2,K.4,S.2,C.2
2.3	The ability to design X-ray shielding of radiographic and cardiac medical rooms.	S.1,S.3,C.2
2.4	The ability to explain the international dispersal of radioactive materials and the accident sequence.	K.3,C.3
3	**Competence:**On successful completion of this course it is expected that students will be able to:	
3.1	Research to solve selected cases in field.	K.3,S.3,C.1
3.2	Demonstrate the use of health physics instrumentations in different fields.	K.2,S.3
3.3	Ilustrate the Protocol of Health Physics Safety and Radioactive waste Disposal	K.2, K.3,S.2

Program Learning Outcomes:

	CLOs
1	**Knowledge:** ***Summary description of the knowledge to be acquired and on completing this program, students will be able to:***
K.1	Explain photon and particle interaction with matter, and identify the hazered from each type of radiation
K.2	list the dosimetry system in medical physics, and the structer of each dosimter
K.3	Understanding the international requlations for radiation protection
k.4	Identify the dose limit for occupational , medical and public exposure
2	**Skills:** ***Summary description of the skills to be acquired and on completing this program, students will be able to:*** :
S.1	Calculate the required shield for radiation protection purpse

CLOs	
S.2	Operate some medical instruments such as that used for the diagnosis of different diseases in medical centers and Demonstrate competency in laboratory techniques and safety.
S.3	Demonstrate scientific concepts and analytical argument, in a clear and organized way, verbally and in writing
3	**Competence:** ***Summary description of the Competence to be acquired and on completing this program, students will be able to***
C.1	Participate effectively in multidisciplinary and/or interdisciplinary teams
C.2	Be able to self-learn in physics-related topics.
C.3	Manage a project with due attention to time and resource management

C. Course Content

No	List of Topics	Contact Hours
1	❖ **Radiation Sources** • Radioactivity • Source of Radiation Exposure(Natural, Human-Made) • Activity • Interaction of Radiation with Matter: Beta Particles – Alpha Particles – Gamma rays - Neutrons	**3**
2	❖ **Standards and Regulations** • Objectives of Standards • Occupational Limits • Non-Occupational (Puplic) Exposures • Regulations	**3**
3	❖ **Radiobiological Basis for Health Physics** • Law of Bergonie and Tribondeau • Degree of Biological Damage • General Radiation Effects and Irradiations in the Individual • Specific Radiation Effects • Acute Radiation exposures • Delayed Effects	**6**

	• Radiation Risk and Risk Models • Dose Response Relationships. • Radiation-Weighted Dose Units: The Sievert and The Rem	
4	❖ **Instrumentations** ❖ Type of detector (area, personal,passive, active) - Gas-Filled detectors - Scintillation counters - Semiconductor detectors - Film dosimetry - luminescence dosimetry - Direct reading personal • Dosimeter properties • Particle Detection Efficiency • Caliberation	**12**
5	❖ **Environmental Health Physics** • Types of Radioactive Waste • Major Radioactive Nuclides • Environmental Releases • Enivronmental Monitoring Programs • Nucleasr Waste Disposal • Transportation • Package Radiation Surveys and Limits • Transport Vehicle Surveys.	6
6	• **ALARA and Shielding** • ALARA principle • **External exposure** - Time - Distance - Shielding calculation (equation for primary shield) Example: X-ray Shielding for radiographic and cardiac rooms Example: Radiation protection in Computer Tomogramohy • **Internal exposure** - In-vivo counting - Bio-assay - Air sampling	6
	❖ **Nuclear Emergencies** • Regulatory Guidance	6

	• Emergency Doses for Radiation Workers • ICRP Emergency Dose Recommendations • Accident Classification • Protective Action Guidelines • Internal Uptakes • Examples of Nuclear Emergencies: Chernobyl • Accident Sequence • Radioactivity Relassed to the Environment • International Dispersal of Radioactive Materials	
	❖ **Students Presentations in Selected Health Physics Topics**	3
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	List source of radiation	Lectures Tutorials Individual Assignment Discussions	Solve some example during the lecture. Quizzes Short exams (mid-term exams) Long exams (final) Discussions during the lectures. Home work. Write a Report
1.2	Recognize occupational and public exposure limits in addition to the safety requirement		
1.3	Outline the Different Types of Health Physics Instrumentations		
1.4	Recognize the Types of Radioactive Wastes and Environmental Monitoring Program		
2.0	Skills		
2.1	The ability to explain the different types of radiation interactions with matter	Analatyical problems in field Individual and Group Assigments Group Discussions	Aissgnments included some open end tasks Problem solving skills Emergency case study Homework Final exam Short exams Reports
2.2	The ability to analyze merits and drawbacks of different health physics instrumentations		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.3	The ability to design X-ray shielding of radiographic and cardiac medical rooms.		
2.4	The ability to explain the international dispersal of radioactive materials and the accident sequence.		
3.0	Competence		
3.1	Research to solve selected cases in field.	Writing an essay Presentations in some selected topics Small Group Discussion. Visits to Hospitals to Improve Students' Expert in Field	Essay (Group Assessment) Presentations (individual and Group Assessment) Homework Final exam Report in field (Individual Assessment)
3.2	Demonstrate the use of health physics instrumentations in different fields.		
3.3	Ilustrate the Protocol of Health Physics Safety and Radioactive waste Disposal		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	6 &14	40 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	--	--
5	Final Practical Exam	--	--
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will supervise by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. Herman Cember and Thomas E. Johnson "Introduction to Health Physics" 4th Eds. McGraw-Hill. **2009**. (Electronic + Hard Copies) 2-Joseph J. Bevelacqua. "Basic Health Physics", 1st Eds., Wiley-VCH, 2010. (Hard Copies)
Essential References Materials	Not Applicable
Electronic Materials	• http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-waste-management.aspx • https://quizlet.com/24704162/radiography-health-physics-flash-cards/ • https://quizlet.com/217730233/rb-4-health-physics-flash-cards/ • https://www.iaea.org/OurWork/ST/NE/NEFW/home.html • http://www.icrp.org/ • https://en.wikipedia.org/wiki/Health_physics • https://www.sfda.gov.sa/ar/medicaldevices/regulations/Documents/4.Ar.Eng.pdf
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board

Item	Resources
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Level Seven

Physics of Biomaterial 4034286-3

Physics of Nuclear Medicine 4034295-4

Physics of Medical Imaging 4034289-3

Physics of Radiotherapy   4034286-4

Computer Application in Medical Physics 4034291-2

COURSE SPECIFICATION

Course Title:	**Physics of Biomaterials**
Course Code:	**4034296-3**
Program:	**B.Sc. Medical Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 3Hrs			
2. Course type			
a. University ☐	College ☐	Department √	Others ☐
b. Required √	Elective ☐		
3. Level/year at which this course is offered: Level 7 / 4th year			
4. Pre-requisites for this course (if any)**: 4034170-4**			
5. Co-requisites for this course (if any)**:**			

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	39	86.6%
2	Blended	6	13.3%
3	E-learning	-	-
4	Correspondence	-	-
5	Other	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture (Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify) (Final Written Exam)	2
	Total	47
Other Learning Hours*		
1	Study (Private study)	70
2	Assignments (Solving problems, Quizzes and Homework out of classroom)	20
3	Library	10
4	Projects/Research Essays/Theses	5
5	Others (specify) (Oral Presentation, Assay)	2
	Total	107

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The Biomaterials course is divided into four sections: macromolecular polymer & material science, physical characterization & properties. Biomaterials will concentrate on fundamental principles in biomedical physics and material science. This course uses a combination of lectures and student presentations, self directed learning to examine the structure and properties of hard materials (ceramics, metals) and soft materials (polymers, hydrogels).

2. Course Main Objective

This course is designed to;

1- List polymers used in medical applications,
2- Difffertiate between different properties of polymers used in medical applictions
3- Define different types of medical biomaterials.
4- Discuss different properties of medical biomaterials. .
5- Identify noval biomaterials uses in medical applications.
6- Differentiate between natural and synthetic hydrogels and their properties as a tissue engineering materials.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Define type and different properties of biomaterials	K1, K5
1.2	Explain Biomaterials Uses in medical applications	K2,K4
1.3	List polymers used in medical applications	K3,K6
2	**Skills:**	
2.1	Differentiate between natural and synthetic polymer usage in medical applications.	S2
2.2	Solve problems in Physics by using suitable mathematical principles	S3
2.3	Analyse and interpret quantitative results	S3
2.4	Discuss different properties of biomaterials	S5
3	**Competence:**	
3.1	Work effectively in groups and exercise leadership when appropriate	C4
3.2	Collect and classify the material for a course	C2
3.3	Communicate effectively in oral and written form	C6,C2

C. Course Content

No	List of Topics	Contact Hours
1	Chapter 1: Introduction to Medical Biomaterials A biomaterial definition, Biomaterials Science, Biocompatibility, Type of Bio materials.& its medical applications The properties of materials depend basically on the type of bonds, which dominate in: (i)The structure, (ii) Interatomic bonds and (iii) Atomic packing factor (APF). Basics Metallic, Crystal Structure Differences between Crystalline & Non-crystalline Solids Properties of biomaterials:	9
2	Chapter (2)Polymers and Polymeric Biomaterials (1) Natural Polymeric Biomaterials (2) Synthetic Polymeric Biomaterials Methods of Synthetic Polymer Preparation Polymers Produced by Addition Polymerization Polymeric Biomaterials & their medical applications Hydrogels: types, properties, main classes, medical applications Bioerosion Process: *Bulk Erosion and Surface Erosion* Chemical degradation process	12
3	Chapter (3): Biomaterials Ceramics Introduction to Bioceramics Bioinert materials Bioactive Ceramics: [1] Bioactive glass [2] Bioactive glass Ceramics and [3] 3.3 Biphasic (multiphasic) calcium phosphates	18
4	Chapter (4): Restorative Materials in Dental Caries Classification: Amalgam – Alloys - Composites: Glass Ionomer Cement: • Composition: Indirect Restorative Materials: Choice of appropriate Restorative material:	6
Total		45 hrs

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Define type and different properties of biomaterials	1- Demonstrating the basic principles through lectures. 2. Discussing	Solve some example, during the lecture. Exams:

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.2	Explain Biomaterials Uses in medical applications	phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final) d) Oral exams Discussions during the lectures.
1.3	List polymers used in medical applications	1. Demonstrating the basic principle of the experiment. 2. Show the best way to write the reports about the experiment. 3. group discussion	Home work. Writing scientific Reports. Doing team research or team project. Discussions during the class.
2.0	**Skills**		
2.1	Differentiate between natural and synthetic polymer usage in medical applications.	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem	1.Midterm's exam. Exams, short quizzes 2.Asking about physical laws previously taught 3.Writing reports on selected parts of the course 4.Discussions of how to simplify or analyze some phenomena
2.2	Solve problems in Physics by using suitable mathematical principles		
2.3	Analyse and interpret different properties		
2.4	Discuss different properties of biomaterials		
3.0	**Competence**		
3.1	Communicate effectively in oral and written form	- Homework - preparing a report on some topics related to the course depending on web sites.	- Evaluation of presentations - Evaluation of reports - Homework - Final exams.
3.2	Collect and classify the material for a course		
3.3	Work effectively in groups and exercise leadership when appropriate.	- Small group discussion. □□□Develop their interest in Science	- Evaluate the work in team. □□Evaluation of the role of each student in

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		through :(field trips, visits to scientific and research.	group assignment Evaluation of student presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	6 &14	40 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	--	--
5	Final Practical Exam	--	--
6	Final Exam (Written Test)	16	50 %
7			
8			

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each student will supervise by an academic adviser in physics Department and the time table for academic advice were given to the student each semester. (2 hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1- Hasirci, Vasif, Hasirci, Nesrin "Fundamentals of Biomaterials" 2nd ed., Springer 2018. 2- Park, Joon, Lakes, R. S. "Biomaterials: An Introuuction", 2nd ed., Springer Science 2007
Essential References Materials	1- Li, Junbai "Nanostructured Biomaterials" 1st ed., Springer, 2010. 2- Zivic, F., Affatato, S., Trajanovic, M., Schnabelrauch, M., Grujovic, N., Choy, K.L "Biomaterials in Clinical Practice" 2nd ed., Springer,2018.
Electronic Materials	www. Biomaterials.com

Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board. There are enough laboratories for experimental physics, provided with air conditions, good data show, and experimental equipment.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch- and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Physics of Nuclear Medicine**
Course Code:	**4034295 – 4**
Program:	**B.Sc. Medical physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm AL-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:							
2. Course type							
a.	University	☐	College ☐	Department	√	Others	☐
b.	Required	√	Elective ☐				
3. Level/year at which this course is offered: **7th level / 4th year**							
4. Pre-requisites for this course (if any): **Nuclear physics / Code:** 4034160-4							
5. Co-requisites for this course (if any): **No-Co-requisite**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	40+39=79	90.8%
2	Blended	8	9.2%
3	E-learning	-	-
4	Correspondence	-	-
5	Other	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	42
3	Tutorial	0
4	**Others** (specify)	2
	Total	89
Other Learning Hours*		
1	Study	110
2	Assignments	20
3	Library	20
4	Projects/Research Essays/Theses	5
5	**Others** (specify)	2
	Total	157

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover the principle of radioisotopes used in medicine and operation of related equipment, such as formation of radionuclides, nonscintillation detectors, nonimaging scintillation detectors, imaging instrumentation, radioisotopes medical applications, nuclear medicine imaging and quality control. This course will provide a conceptual and experimental background in nuclear medicine physics sufficient to enable students to take courses that are more advanced in related fields.

2. Course Main Objective

Studying Physical principles of radioisotopes used in medicine and biology and operation of related equipment.

This course is designed to demonstrate and consolidate the physical principles of radioisotopes used in medicine and biology and operation of related equipment, lecture include;
1 Basic Nuclear Medicine Physics,
2 Formation of Radionuclides,
3 Nonscintillation Detectors,
4 Nonimaging Scintillation Detectors,
5 Imaging Instrumentation,
6 Radioisotopes medical applications
7 Nuclear medicine imaging
9 Quality Control
10 Radiation protection in nuclear medicine

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Acquire the major aspects of nature and subject of nuclear medicine and its clinical applications.	K1
1.2	Recognize how to analysis data which is used to diagnose with the aid of different medical devices such as dose calibrator, gamma camera, and positron emission tomography.	K3
1.3	Outline the principles of physics of different nuclear medicine devices and their modern advances.	K2
1...		
2	**Skills :**	
2.1	Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in nuclear medicine and related fields of studies.	S1
2.2	Analyze and evaluate image information by using computational tools to interpret experimental data relevant to medical imaging by using packages from different theoretical and experimental resources, and perspectives.	S3
2.3	Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.	S5
2...		
3	**Competence:**	

CLOs		Aligned PLOs
3.1	Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of nuclear medicine physics issues.	C1
3.2	Implement all kinds of relevant information in nuclear medicine through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.	C3
3.3	Work effectively in groups as well as individuals and appraise the cooperation through teamwork to assess and criticize various emergent problems.	C4
3.4	Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.	C5
3.5	Summarize, document, report, and reflect on own findings.	C6

C. Course Content

No	List of Topics	Contact Hours
1	❖ **Basic of Nuclear Medicine Physics,** 1. Fundamental concepts 2. The power of nuclear medicine 3. Historical overview 4. Current practice of nuclear medicine The role of physics in nuclear medicine	3
2	❖ **Decay of Radioactivity** A. ACTIVITY 1. The Decay Constant ,2. Definition and Units of Activity B. EXPONENTIAL DECAY 1. The Decay Factor, 2. Half-Life, 3. Average Lifetime C. METHODS FOR DETERMINING DECAY FACTORS 1. Tables of Decay Factors, 2.Pocket Calculators, 3.Universal Decay Curve D. IMAGE-FRAME DECAY CORRECTIONS E. SPECIFIC ACTIVITY F. DECAY OF A MIXED RADIONUCLIDE SAMPLE G. PARENT-DAUGHTER DECAY 1. The Bateman Equations, 2.Secular Equilibrium 3.Transient Equilibrium , 4.No Equilibrium	6
3	❖ **Radionuclide and Radiopharmaceutical Production** A. REACTOR-PRODUCED RADIONUCLIDES 1. Reactor Principles, 2. Fission Fragments , 3. Neutron Activation B. ACCELERATOR-PRODUCED RADIONUCLIDES 1. Charged-Particle Accelerators, 2. Cyclotron Principles 3. Cyclotron-Produced Radionuclides	6

	C. RADIONUCLIDE GENERATORS D. RADIONUCLIDES FOR NUCLEAR MEDICINE 1.General Considerations, 2. Specific Considerations E. RADIOPHARMACEUTICALS FOR CLINICAL APPLICATIONS 1.General Considerations, 2. Labeling Strategies 3.Technetium-99m-Labeled Radiopharmaceuticals 4.Radiopharmaceuticals Labeled with Positron Emitters 5.Radiopharmaceuticals for Therapy Applications 6.Radiopharmaceuticals in Clinical Nuclear Medicine	
4	❖ **Radiation Detectors** A. GAS-FILLED DETECTORS 1. Basic Principles 2. Ionization Chambers 3. Proportional Counters 4. Geiger-Müller Counters B. SEMICONDUCTOR DETECTORS C. SCINTILLATION DETECTORS 1. Basic Principles 2. Photomultiplier Tubes 3. Photodiodes 4. Inorganic Scintillator 5. Considerations in Choosing an Inorganic Scintillator 6. Organic Scintillator	3
5	❖ **The Gamma Camera: Basic Principles** A. GENERAL CONCEPTS OF RADIONUCLIDE IMAGING B. BASIC PRINCIPLES OF THE GAMMA CAMERA 1. System Components 2. Detector System and Electronics 3. Collimators 4. Event Detection in a Gamma Camera C. TYPES OF GAMMA CAMERAS AND THEIR CLINICAL USES **First Periodic Exam**	3
6	❖ **The Gamma Camera: Performance Characteristics** A. BASIC PERFORMANCE CHARACTERISTICS 1. Intrinsic Spatial Resolution, 2. Detection Efficiency, 3. Energy Resolution, 4. Performance at High Counting Rates B. DETECTOR LIMITATIONS: NONUNIFORMITY AND NONLINEARITY 1. Image Nonlinearity, 2. Image Nonuniformity, 3. Nonuniformity Correction Techniques, 4. Gamma Camera Tuning C. DESIGN AND PERFORMANCE CHARACTERISTICS OF PARALLEL-HOLE COLLIMATORS 1. Basic Limitations in Collimator Performance, 2. Septal Thickness	6

	3. Geometry of Collimator Holes, 4. System Resolution D. MEASUREMENTS OF GAMMA CAMERA PERFORMANCE 1. Intrinsic Resolution, 2. System Resolution, 3. Spatial Linearity 4. Uniformity, 5. Counting Rate Performance, 6. Energy Resolution 7. System Sensitivity	
7	❖ **Image Quality in Nuclear Medicine** A. BASIC METHODS FOR CHARACTERIZING IMAGE QUALITY B. SPATIAL RESOLUTION 1. Factors Affecting Spatial Resolution, 2. Methods for Evaluating Spatial Resolution C. CONTRAST D. NOISE 1. Types of Image Noise, 2. Random Noise and Contrast-to-Noise Ratio E. OBSERVER PERFORMANCE STUDIES 1. Contrast-Detail Studies, 2. Receiver Operating Characteristic Studies	3
8	❖ **Single Photon Emission Computed Tomography** A. SPECT SYSTEMS 1. Gamma Camera SPECT Systems, 2. SPECT Systems for Brain Imaging, 3. SPECT Systems for Cardiac Imaging, 4. SPECT Systems for Small-Animal Imaging B. PRACTICAL IMPLEMENTATION OF SPECT 1. Attenuation Effects and Conjugate Counting, 2. Attenuation Correction, 3. Transmission Scans and Attenuation Maps, 4. Scatter Correction, 5. Partial-Volume Effects C. PERFORMANCE CHARACTERISTICS OF SPECT SYSTEMS 1. Spatial Resolution, 2. Volume Sensitivity, 3. Other Measurements of Performance, 4. Quality Assurance in SPECT D. APPLICATIONS OF SPECT	3
9	❖ **Positron Emission Tomography** A. BASIC PRINCIPLES OF PET IMAGING 1. Annihilation Coincidence Detection, 2. Time-of-Flight PET, 3. Spatial Resolution: Detectors, 4. Spatial Resolution: Positron Physics, 5. Spatial Resolution: Depth-of-Interaction Effect, 6. Spatial Resolution: Sampling, 7. Spatial Resolution: Reconstruction Filters, 8. Sensitivity, 9. Event Types in Annihilation Coincidence Detection B. PET DETECTOR AND SCANNER DESIGNS 1. Block Detectors, 2. Modified Block Detectors, 3.Whole-Body PET Systems, 4. Specialized PET Scanners, 5. Small-Animal PET Scanner C. DATA ACQUISITION FOR PE 1. Two-Dimensional Data Acquisition, 2. Three-Dimensional Data Acquisition, 3. Data Acquisition for Dynamic Studies and Whole-Body Scans D. DATA CORRECTIONS AND QUANTITATIVE ASPECTS OF PET	3

	1. Normalization, 2. Correction for Random Coincidences, 3. Correction for Scattered Radiation, 4. Attenuation Correction, 5. Dead Time Correction, 6. Absolute Quantification of PET Images E. PERFORMANCE CHARACTERISTICS OF PET SYSTEMS F. CLINICAL AND RESEARCH APPLICATIONS OF PET	
10	❖ **Radiation Safety and Health Physics** A. QUANTITIES AND UNITS 1.Dose-Modifying Factors, 2. Exposure and Air Kerma B. REGULATIONS THE USE OF RADIONUCLIDES 1. Nuclear Regulatory Commission Licensing and Regulations, 2. Restricted and Unrestricted Areas, 3.Dose Limits, 4.Concentrations for Airborne Radioactivity in Restricted Areas, 5.Environmental Concentrations and Concentrations for Sewage Disposal, 6.Record-Keeping Requirements, 7. Recommendations of Advisory Bodies C. SAFE HANDLING OF RADIOACTIVE MATERIALS 1. The ALARA Concept, 2. Reduction of Radiation Doses from External Sources, 3. Reduction of Radiation Doses from Internal Sources, 4.Laboratory Design, 5.Procedures for Handling Spills D. DISPOSAL OF RADIOACTIVE WASTE E. RADIATION MONITORING 1. Survey Meters and Laboratory Monitors, 2. Personnel Dosimeter, 3.Wipe Testing.	6
	❖ **Revision and Solved problems, Second Periodic Exam**	3
	Total	**45hrs**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize facts, principle and concepts of Nuclear Medicine Physics.	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point 4. Discussions 5. Brain storming	Solve some example during the lecture. Exams: a) Quizzes (E-learning) b) Short exams (mid-term exams) c) Long exams (final) d) Oral exams Discussions during the lectures.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		6. Start each chapter by general idea and the benefit of it.	
1.2	Describe concepts, Procedures of some experiments in Nuclear Medicine Physics.	1. Demonstrating the basic principle of the experiment. 2. Show the best ways to perform the experiments 3. Show the best ways to demonstrate the results. 4. Show the best way to write the reports about the experiment. 5. Discussion with the student about the results.	Home work. Writing scientific Reports. Doing team research or team project. Doing team work to perform some experiments Discussions during the class.
2.0	**Skills**		
2.1	Apply the laws of Nuclear Medicine Physics.	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem	1.Midterm's exam. Exams, short quizzes 2.Asking about physical laws previously taught 3.Writing reports on selected parts of the course 4.Discussions of how to simplify or analyze some phenomena
2.2	Solve problems by using suitable mathematical principles		
2.3	Analyse and interpret quantitative results		
2.4	Express the phenomena mathematically.		
3.0	**Competence**		
3.1	Communicate effectively in oral and written form	• Homework • preparing a report on some topics related to the course depending on web sites.	• Evaluation of presentations • Evaluation of reports • Practical exam • Homework. Final exams.
3.2	Collect and classify the material for a course		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	6 &14	20 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	11	10 %
5	Final Practical Exam	15	10%
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will supervise by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Simon Cherry, Michael E. Phelps "Physics in Nuclear Medicine" 3rd add," Saunders 2003
Essential References Materials	- 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
Electronic Materials	- 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	-http :// www.springer.com - http:// www.sciencedirect.com -http:// www.gigabedia .org

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.

Item	Resources
	There are enough laboratories for experimental physics, provided with air conditions, good data show, and experimental equipment.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit Curriculum and Test Development Unit	• Item Analysis Data • Course Reports Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Medical physics Committee
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Physics of Medical Imaging**
Course Code:	**4034289-3**
Program:	**B.Sc. Medical physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm AL-Qura University**

Table of Contents

A. Course Identification

1. Credit hours:								
2. Course type								
a.	University	☐	College	☐	Department	√	Others	☐
b.	Required	√	Elective	☐				
3. Level/year at which this course is offered: **7th level / 4th year**								
4. Pre-requisites for this course (if any)**: Radiation Medical Physics (2) / Code: 4033292-4**								
5. Co-requisites for this course (if any)**: No-Co-requisite**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	39	86.6%
2	Blended	6	13.3%
3	E-learning	-	-
4	Correspondence	-	-
5	Other	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	45
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	2
	Total	47
Other Learning Hours*		
1	Study	70
2	Assignments	20
3	Library	10
4	Projects/Research Essays/Theses	5
5	Others (specify)	2
	Total	107

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover the principle of Imaging used in medicine and operation of related equipment, such as X-rays, CT, MRI Nuclear medicine imaging and ultrasound including imaging instrumentation, medical applications, and quality control. This course will provide a conceptual and experimental background in Medical imaging physics sufficient to enable students to take courses that are more advanced in related fields.

2. Course Main Objective

Studying Physical principles of radioisotopes used in medicine and biology and operation of related equipment.

This course is designed to demonstrate and consolidate the physical principles of radioisotopes used in medicine and biology and operation of related equipment, lecture include;

1 Basic Nuclear Medicine Physics,
2 Formation of Radionuclides,
3 Nonscintillation Detectors,
4 Nonimaging Scintillation Detectors,
5 Imaging Instrumentation,
6 Radioisotopes medical applications
7 Nuclear medicine imaging
9 Quality Control
10 Radiation protection in nuclear medicine

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Acquire the major aspects of nature and subject of Medical imaging and its clinical applications.	K1
1.2	Recognize how to analysis data which is used to diagnose with the aid of different medical devices such as X ray, CT, MRI, US, Gamma camera, and Positron emission tomography.	K3
1.3	Outline the principles of physics of different Medical imaging devices and their modern advances.	K2
1...		
2	**Skills :**	
2.1	Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in Medical imaging and related fields of studies.	S1
2.2	Analyze and evaluate image information by using computational tools to interpret experimental data relevant to medical imaging by using packages from different theoretical and experimental resources, and perspectives.	S3
2.3	Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.	S5
2...		
3	**Competence:**	

	CLOs	Aligned PLOs
3.1	Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of nuclear medicine physics issues.	C1
3.2	Implement all kinds of relevant information in Medical imaging through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.	C3
3.3	Work effectively in groups as well as individuals and appraise the cooperation through teamwork to assess and criticize various emergent problems.	C4
3.4	Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.	C5
3.5	Summarize, document, report, and reflect on own findings.	C6

C. Course Content

No	List of Topics	Contact Hours
1	❖ **1 Introduction to digital image** 1. processing 2. Digital images 3. Image quality 4. Basic image operations	3
2	❖ **Radiography** 5. Introduction 6. X-rays 7. Interaction with matter 8. X-ray detectors 9. Dual-energy imaging 10. Image quality 11. Equipment 12. Clinical use 13. Biologic effects and safety 14. Future expectations	6
3	❖ **X-ray computed tomography** 1. Introduction 2. X-ray detectors in CT 3. Imaging 4. Cardiac CT 5. Dual-energy CT 6. Image quality 7. Equipment 8. Clinical use 9. Biologic effects and safety Future expectations	6
4	**Ultrasound imaging** 1. Introduction 2. Physics of the Ultrasound signal	8

	3. Interaction transmitted with tissue 4. Signal detection and detector 5. Imaging 6. Image quality 7. Equipment 8. Clinical use 9. Biologic effects and safety ❖ Future expectations	
	❖ **First Periodic Exam**	3
5	❖ **Magnetic resonance imaging** 1. Introduction 2. Physics of the transmitted signal 3. Interaction with tissue 4. Signal detection and detector 5. Imaging 6. Image quality 7. Equipment 8. Clinical use 9. Biologic effects and safety 10. Future expectations	8
6	**Nuclear medicine imaging** 1. Introduction 2. Radionuclides 3. Interaction of γ-photons and particles 4. with matter 5. Data acquisition 6. Imaging 7. Image quality 8. Equipment 9. Clinical use 10. Biologic effects and safety Future expectations	8
7		0
	❖ **Revision and Solved problems, Second Periodic Exam**	3
Total		**45hrs**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recognize facts, principle and concepts of Medical imaging Physics.	1- Demonstrating the basic principles through lectures.	Solve some example during the lecture. Exams:

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	a) Quizzes (E-learning) b) Short exams (mid-term exams) c) Long exams (final) d) Oral exams Discussions during the lectures.
1.2	Describe concepts, Procedures of some experiments in Medical imaging Physics..	1. Demonstrating the basic principle of the experiment. 2. Show the best ways to perform the experiments 3. Show the best ways to demonstrate the results. 4. Show the best way to write the reports about the experiment. 5. Discussion with the student about the results.	Home work. Writing scientific Reports. Doing team research or team project. Doing team work to perform some experiments Discussions during the class.
2.0	**Skills**		
2.1	Apply the laws of Medical imaging Physics..	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem	1.Midterm's exam. Exams, short quizzes 2.Asking about physical laws previously taught 3.Writing reports on selected parts of the course 4.Discussions of how to simplify or analyze some phenomena
2.2	Solve problems by using suitable mathematical principles		
2.3	Analyse and interpret quantitative results		
2.4	Express the phenomena mathematically.		
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Communicate effectively in oral and written form	• Homework • preparing a report on some topics related to the course depending on web sites.	• Evaluation of presentations • Evaluation of reports • Practical exam • Homework. Final exams.
3.2	Collect and classify the material for a course		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	6 &14	40 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	--	--
5	Final Practical Exam	--	--
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each student will supervise by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Paul Suetens " Fundamentals of Medical Imaging "2nd add", Cambridge University Press 2009
Essential References Materials	- Jerrold T. Bushberg, J. Anthony Seibert "The Essential Physics of Medical Imaging" Third Edition- LWW 2011 - Peter F. Sharp, Howard G. Gemmell and Alison D. Murray "Practical Nuclear Medicine 3rd add." Springer–Verlag London Limited 2005
Electronic Materials	- Journal of medical physics; http://www.jmp.org.in/md.asp

Other Learning Materials	-http :// www.springer.com - http:// www.sciencedirect.com -http:// www.gigabedia .org

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board. There are enough laboratories for experimental physics, provided with air conditions, good data show, and experimental equipment.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit Curriculum and Test Development Unit	• Item Analysis Data • Course Reports Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

H. Specification Approval Data

Council / Committee	Medical physics
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	**Physics of Radiotherapy**
Course Code:	**4034286-4**
Program:	**Medical Physics**
Department:	**Physics**
College:	**Applied science**
Institution:	**UMM-AL-QURA University**

Table of Contents

A. Course Identification

1. Credit hours:	**4 (3+1+0) Hrs**							
2. Course type								
a.	University	☐	College	☐	Department	✓	Others	☐
b.	Required	✓	Elective	☐				
3. Level/year at which this course is offered:	**7th Level /4th Year**							
6. Pre-requisites for this course (if any):):	**Radiation Medical Physics (2) (4033292-4)**							
5. Co-requisites for this course (if any)**:**	**NIL**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom (including Laboratory classroom)**	40+39=79	90.8%
2	**Blended**	8	9.2%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other**	-	-

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture** (Class Quizzes and Homework solving, Class Test Exams, oral discussion, student oral presentation)	45
2	**Laboratory/Studio**	42
3	**Tutorial**	0
4	**Others** (specify) (Final Written Exam)	2
	Total	89
Other Learning Hours		
1	**Study** (Private study including the laboratory hours)	110
2	**Assignments** (Solving problems, Quizzes and Homework out of classroom)	20
3	**Library**	20
4	**Projects/Research Essays/Theses**	5
5	**Others** (specify) (Oral Presentation, Assay)	2
	Total	157

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides the necessary practical and theoretical background for the support of a radiotherapy physics service within radiotherapy. The course provides the bais for understanding physical principles within radiotherapy, focusing on clinical application. Important topis are: Equipment for generating/delivering ionizing elctron- and photon radiation, clinical radiation dosimetry, characteristics and specifications of radiation fields, treatment planning (volume definitions, field setup, fractionations, modern techniques and dose calculation algoritms), quality assurance, and posibilities and limtations related to treatment modalities like brachytherapy and particle therapy.

2. Course Main Objective

At the end of this course, the student should be able to:

- Describe the basic principles underlying radiotherapy methods;
- Explain the principles of radiotherapy equipment;
- Define the characteristics of clinical beams and their measurement;
- Describe dosimetry measurements used in radiotherapy;
- Perform basic treatment planning in radiotherapy;
- Perform basic QC for equipment in radiotherapy;
- Describe the use of sealed and unsealed sources in radiotherapy;
- Discuss a range of clinical applications.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:** On successful completion of this course it is expected that students will be able to:	
1.1	Describe the basic principles underlying radiotherapy methods;	K1,k3
1.2	Explain the principles of radiotherapy equipment;	k3
1.3	Define the characteristics of clinical beams and their measurement;	K2

CLOs		Aligned-PLOs
2	**Skills:** On successful completion of this course it is expected that students will be able to:	
2.1	**The ability Solve problems related to the patient dose calculation**	K3,S3
2.2	**The ability to choose the appropriated field arrangement technique for treatment planning**	K1,K2
2.3	**The ability Compare between the electron and photon beam therapy.**	K2,S1
2.4	**Demonstrate the dose distribution using manual and computerized methods.**	K1,S3
3	**Competence:** On successful completion of this course it is expected that students will be able to:	
3.1	Show responsibility for self-learning to be aware with recent developments in physics	C1
3.2	Work effectively in groups arrangements of selected clinical	C2

Program Learning Outcomes:

CLOs	
1	**Knowledge:** ***Summary description of the knowledge to be acquired and on completing this program, students will be able to:***
K.1	List the patient dose computation methods
K.2	Recognize the basic physical principles of radiotherapy treatment planning
K.3	Outline the merits and drawbacks of each equipment used in radiotherapy

CLOs	
2	**Skills:** ***Summary description of the skills to be acquired and on completing this program, students will be able to: :***
S.1	Perform basic treatment planning in radiotherapy;
S.2	Perform basic QC for equipment in radiotherapy;
S.3	Summarize, document, report, and reflect on own findings.
3	**Competence:*Summary description of the Competence to be acquired and on completing this program, students will be able to***
C.1	Participate effectively in multidisciplinary and/or interdisciplinary teams
C.2	Be able to self-learn in physics-related topics.
C.3	Manage a project with due attention to time and resource management

C. Course Content

No	List of Topics	Contact Hours
1	❖ **Radiation in the Treatment of Cancer** Kilovoltage x-ray Units Linear Accelerator	**6**

	Cobalt Machines Simulator	
2	❖ **Dose Distribution and Scatter analysis** Phantoms Depth Dose Distribution Percentage Depth Dose Tissue-Air Radio Scatter-air Ratio	**6**
3	❖ **Patient dose Computation Methods** Acquisition of patient data Treatment simulation Source to axis distance and isocentric techniques	**6**
4	❖ **A system of Dosimetric calculations** Dose calculation parameters Practical applications (a)Accelerator Calculations (b)Cobalt-60 Calculations (c) Irregular Fields (D)Asymmetric Fields	6
5	❖ **Treatment Planning I:Isodose Distribution** Isodose chart Measurement of isodose curves.	3
6	❖ **Treatment Planning: Patient data, Corrections, and set-up** parameters of isodose curves Wedge filters	6

	Combination of radiation fields Wedge field techniques Tumor dose specification for external photon beams	
	❖ **Treatment Planning: Field Shaping, Skin dose, and Field Separation.** Field blocks Field shaping Skin dose Separation of adjacent fields	3
	❖ **Electron beam Therapy.** Electron interactions Determination of absorbed dose Characteristics of clinical electron beams Field shaping	3
	❖ **Dose Fractionation in radiotherapy.** ❖ **Quality Assurance**	3
	❖ **Students Presentations in Selected Radiotherapy Topics**	3
Total		45

Labaratory Experiments.

×-Ray Machine and Concept of Radiation Therapy

Radiation Units and Safety Measurements

Beam Quality Measurements (Calibration Part-I)

Beam Quantity and Output Measurements (Calibration Part-II)

Inverse Square Law

Scatter Factors

Beam Profiles

Dose Rate Variation with Operation Parameters

Patient Dose Calculations

Treatment Planning System (Part–I)

Treatment Planning System (Part–II)

Beam Simulation

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	**List the patient dose computation methods**	Lectures Tutorials Individual Assignment Discussions	a) Solve some example during the lecture. b) Quizzes c) Short exams (mid- term exams) d) Long exams (final) e) Discussions during the lectures. f) Home work.
1.2	**Recognize the basic physical principles of radiotherapy treatment planning**		
1.3	**Outline the merits and drawbacks of each equipment used in radiotherapy**		
2.0	Skills		
2.1	**The ability Solve problems related to the patient dose calculation**	• Analatyical problems in field • Individual Assigments • Group Assigments	• Aissgnments included calculation of patient dose in selscted clinical situations

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	**The ability to choose the appropriated field arrangement technique for treatment planning**	• Lab work	• Open ended tasks (clinical treatment plans problem) • Lab exam • Homework • Final exam • Short exams • Reports
2.3	**The ability Compare between the electron and photon beam therapy.**		
2.4	**Demonstrate the protocol for both manual and computerized radiotherapy treatment plannig**	• Writing an essay • Presentations in some selected topics • Small Group Discussion. Visits to Hospitals to Improve Students' Expert in Field	• Essay (Group Assessment) • Presentations (individual and Group Assessment) • Lab exam • Homework • Final exam • Report on field (Individual Assessment)
3.0	**Competence**		
3.1	**Demonstrate the protocol for both manual and computerized radiotherapy treatment plannig**	• Writing an essay • Presentations in some selected topics • Small Group Discussion. Visits to Hospitals to Improve Students' Expert in Field	• Essay (Group Assessment) • Presentations (individual and Group Assessment) • Lab exam • Homework • Final exam • Report on field (Individual Assessment)
3.2	**Choose the appropriate field arrangements for selected clinical treatment plans**		
3.3	**Illustrate the Protocol of optimum setup of quality assurance for selected clinical situations**	• Group Discussions • Reports • Presentations • Treatment plans of selected clinical situation	• Essay (Group Assessment) • Presentations (individual and Group Assessment)

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		• Simulation radiotherapy treatment planning	• Report in field (Individual Assessment) • Treatment plans evaluation using some websites

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Assignments, Quizzes and Homework**	**Weekly**	**10 %**
2	**Class Test Exam (Two Written Tests)**	**6 &14**	**20 %**
3	**Mid Term Exam (practical)**	**--**	**--**
4	**Reports and essay (e.g. Oral Presentation, Research, and Group Project)**	**11**	**10 %**
5	**Final Practical Exam**	**15**	**10%**
6	**Final Exam (Written Test)**	**16**	**50 %**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each student will supervise by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. F. M. Khan, "The Physics of Radiation Therapy", 5th Edition, Lippincott Williams and Wilkins,U.S.A.,**2015.** (Electronic + Hard Copies). 2. E. B. Podgorsak, (Editor), Radiation Oncology Physics: A Handbook for Teachers and Students, IAEA , **2005**. (electronic copy) (http://www-pub.iaea.org/MTCD/publications/PDF/Pub1196_web.pdf)
Essential References Materials	Not Applicable
Electronic Materials	• http://www.ennovations.co.uk/p/20/interactive-radiotherapy-planning-for-students-irps-version-401 • http://radonc.uams.edu/research/medical-physics-research/dicoman/ • https://www.iaea.org/topics/cancer-treatment-radiotherapy • https://www.radiologyinfo.org/en/info.cfm?pg=ebt https://www.cancer.gov/about-cancer/treatment/types/radiation-therapy/radiation-fact-sheet
Other Learning Materials	1- Philip Mayles,Alan Nahum"handbook of radiotherapy physics:theory and practice" Taylor&Francis, **2007.** 2- Faiz.M.Khan "Treatment Planning in radiation Oncology" 3rd aedition,Lippincott Williams&Wilkins, **2011**.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation, including good air condition, good Data show, suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	In each class room and laboratories, there is a data show, and board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee	• Item Analysis Data • Teacher Feedback • Student Feedback

Evaluation Areas/Issues	Evaluators	Evaluation Methods
	• External Reviewers such as the ASIIN Accreditation Agency	• Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

COURSE SPECIFICATION

Course Title:	Computer Application in Medical Physics
Course Code:	4034291-2
Program:	Medical Physics Program
Department:	Department of Physics
College:	College of Applied Science
Institution:	Umm Al – Qura University

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type **a.** University ☐ College ☐ Department ☒ Others ☐ **b.** Required ☒ Elective ☐	
3. Level/year at which this course is offered:	Level 6 / 3th Year
4. Pre-requisites for this course (if any):	Radiation Medical Physics (2) (4033292-4)
5. Co-requisites for this course (if any):	Not Applicable

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom (Lec+laboratory) 15+42=57	49	86%
2	Blended	8	14%
3	E-learning	--	--
4	Correspondence	--	--
5	Other (Lab)	--	--

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture** (**Quizzes, Homework, Class Test Exams, oral discussion**)	15
2	**Laboratory/Studio**	42
3	**Tutorial**	0
4	**Others** (specify) (**Final Written Exam+ Final Lab Exam**)	4
	Total	61
Other Learning Hours		
1	**Study** (Private study)	64

2	**Assignments (Quizzes and Homework Solving)**	**10**
3	**Library**	**2**
4	**Projects/Research Essays/Theses**	**--**
5	**Others** (specify) (**Oral Presentation, Assay**)	**1**
	Total	**77**

* The length of time that a learner takes to complete learning activities that lead to the achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

2. Course Main Objective

1. What is the main purpose of this course?

Computer software is used for diagnosis of diseases. It can be used for the examination of internal organs of the body. Advanced computer-based systems are used to examine delicate organs of the body. Some of the complex surgeries can be performed with the aid of computers. Medical imaging is a vast field that deals with the techniques to create images of the human body for medical purposes. Many of the modern methods of scanning and imaging are largely based on the computer technology.

After completing this course student should recognize the followings:

1. The use of Information & Communication Technologies (ICT) in medicine.

2. The improvement of the medical image quality using image processing software.
3. The modern application of computer in medical areas as a surgical tool.

3. Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:** On successful completion of this course it is expected that students will be able to:	
1.1	Summarize general areas of image processing.	***K1***
1.2	Acquire the basics of digital image formation, acquisition, noise, and processing.	***K3***
1.3	Recognize the fundamentals of image processing and enhancing techniques.	***K3***
2	**Skills** On successful completion of this course it is expected that students will be able to:	
2.1	Explain linear smoothing filters and non-linear smoothing filters.	***K3, S1***
2.2	Comparison between low pass filter and high pass filter.	***S1, S2***
2.3	Differentiate between Clipping, Point Operations and Look-Up Table (LUT).	***S2***
2.4	Design different codes using a programming language to locate and enhance the medical signal and/or image.	***S3***
2.5	Differentiate between different types of Histograms	***S2, S3***
2.6	Explain linear smoothing filters and non-linear smoothing filters.	***S3, S4***

CLOs		Aligned PLOs
2.7	Interpret the effect of edge detection different operators (e.g. Laplacian, Sobel and Prewitt) on the image details.	***S3, S4***
3	**Competence** On successful completion of this course it is expected that students will be able to:	
3.1	Work effectively in groups as well as individuals.	***C2, C3, C4***
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.	**C6**

Program learning Outcomes*

Knowledge: ***Summary description of the knowledge to be acquired and on completing this program, students will be able to:***	
K1	Acquire the major aspects of nature and subject of medical physics and the application of physics to medicine.
K2	List matter in various forms, including crystals, semiconductors, atoms, nuclei and understand the principles of laser and its application in medicine.
K3	Recognize Bioinformatics in order to know how to analysis data which is used to diagnose with the aid of different medical devices such as X- ray machines, gamma camera, accelerator and nuclear magnetic resonance.
K4	Define different quantitative, mathematical science and physical tools analyze problems and list some foundations of systems theory to solve and analysis different problems.
K5	Recognize the nature, properties, dosimetery of radiation and basics of radiation protection and also medical effects of ionizing and non-ionizing radiation.
K6	Outline the principles of physics of different medical radiation devices and their modern advances, especially in medical radiation therapy and different applications in medical physics.

Skills: ***Summary description of the skills to be acquired and on completing this program, students will be able to:***	
S1	Reorganize mathematical and physical formulas and demonstrate skills of critical thinking and analytical reasoning to solve problems in medical physics and related fields of studies.
S2	Formulate and test hypotheses using appropriate experimental design and analysis of data (Computer simulation) and integrate IT-based solutions into the user environment effectively.
S3	Analyze and evaluate information by using computational tools to interpret experimental data relevant to medical physics by using packages from different theoretical and experimental resources, and perspectives.
S4	Operate some medical instruments such as that used for the diagnosis of different diseases in medical centers and demonstrate competency in laboratory techniques and safety.
S5	Use scientific literature effectively and prepare technical reports that for individual student or making a group of researchers.
S6	Justify ethical, social and legal responsibilities concerning medical physics.
S7	
Competence: ***Summary description of the Competence to be acquired and on completing this program, students will be able to:***	
C1	Illustrate and employ the processes of scientific inquiry and research methods through use effective information and communications technology (IT) tools and use the basic software, to ensure globally understand of medical physics issues.
C2	Demonstrate scientific concepts and analytical argument, in a clear and organized way, verbally and in writing.
C3	Implement all kinds of relevant information in medical physics through the use of local and internationally accessible libraries, information database, and electronic data and use that information in problem solving activities.
C4	Work independently and demonstrate the ability to manage time and to work as a part of a team, and learn independently

C5	Prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions and justify ethical, social and legal responsibilities concerning the scientific regulations.
C6	Summarize, document, report, and reflect on own findings.

C. Course Content

No	List of Topics	Contact Hours
1	**Computer Digital and Analog Basics** **Storage and transfer of data between computer number systems** **Decimal form (Base 10)** **Binary form** **Conversions between decimal and binary forms**	1
2	**Digital Representation of Data Bits, Bytes, and Words** **Digital Representation of Different Types of Data** **Storage of Positive Integers** **Binary Representation of Signed Integers** **Analog Data And Conversion Between Analog and Digital Forms** **Advantages and Disadvantages of the Analog and Digital Forms** **Solved problems** **Quiz 1** **Quiz 2**	2
3	**Computer in Imaging, Nuclear Medicine** **Pulse-Height Analyzer** **Digital Image Formats in Nuclear Medicine** **Nuclear medicine, computers is used for:** • **The Data Acquisition,** • **Data Storage.** • **Processing of Data.** **Formation of digital images.**	2
4	**Display, Conversion of a Digital Image into an Analog Video Signal.** **Grayscale Cathode Ray Tube Monitors.** **Image Acquisition in Nuclear Medicine.** **Frame Mode (Static, dynamic, gated).** **List-mode acquisition.** **The advantage of list-mode acquisition.** **The disadvantage of list-mode acquisition.** **Solved problems.** **Quiz 1** **1st Class Test Exam**	2
5	**Information & Communication Technologies (ICT) and medicine** • **Patient records** • **Medical equipments** • **Research** • **Web-based diagnosis** • **Expert systems**	2

	• Communications Computers and the disabled	
	Digital Image Processing Function of Image Processing General Areas of Image Processing Clipping • Point Operations • Look-Up Table (LUT) Contrast Point Operation Image Processing in Nuclear Medicine Brightness of Image Image Contrast Image Contrast Differences	2
	Histograms Image Histogram Region or ROI (region of interest) Image Histogram Operations • Histogram Stretching • Histogram Sliding • Histogram equalization • Other Histogram Information Local Operations Convolution ((kernel) • Low Pass Filter • High Pass Filter 2nd Class Test Exam	2
	Smoothing Filters Linear Smoothing Filters Mean Or Average Filter Gaussian Smoothed Filter Non-linear Smoothing Filters Median Filter Enhance Filters • Edge enhancement • Edge detection • Directional Edge Detection • Laplacian Edge Detection • Sobel Edge Detection Prewitt Edge Detection	2
Total		

Experimens of Computers in Medical Physics

1	Calculation of linear attenuation coefficients (μ) and CT numbers. RADIOLOGY.

2	Modelling of radiation beams in Treatment Planning Systems (TPS). RADIATION THERAPY.
3	Introduction to Monte Carlo Modelling and readymade codes.
4	Downloading and installing EGSnrc code.
5	Downloading and installing MCNP code.
6	Modelling the departmental x-ray tube (EGSnrc).
7	Modelling the departmental x-ray tube (MCNP).
8	Generating the output of the machine at different energies.
9	Generating the output of the machine at different tube current.
10	Simulating dose at different depths in a patient.
11	Downloading SpekCalc.
12	Calculation of spectrum of the departmental x-ray tube at different energies using SpekCalc.

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge** On successful completion of this course it is expected that students will be able to:		
1.1	Summarize general areas of image processing.	Classroom lectures Tutorials and independent study assignments	Graded homework. - Assignments. - Quizzes.
1.2	Acquire the basics of digital image formation, acquisition, noise, and processing.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.3	Recognize the fundamentals of image processing and enhancing techniques.	- Individually hand written assignments required use of library reference material and web sites to identify the information. required to complete tasks. E-learning through the university website.	- Oral Group Discussion. - Class tests (e.g. 15 minute multiple choice test on content on completion of each topic) with a defined . ratio of the final assessment of the course. Multiple choice knowledge item on final exam •
2.0	**Skills** On successful completion of this course it is expected that students will be able to:		
2.1	Explain linear smoothing filters and non-linear smoothing filters.	- Explain and justify several unsolved examples and unsolved problems in lecture under the supervision of the instructor. - Encourage the students to analyze and enhance the medical images using certain image processing program packages (e.g. MATLAB, Image J software).	- Graded homework. - Class exams. - Final Exam. - Group and individual assignments require application of analytical tools in problem solving tasks. - Class participation.
2.2	Comparison between low pass filter and high pass filter.		
2.3	Differentiate between Clipping, Point Operations and Look-Up Table (LUT).		
2.4	Design different codes using a programming language to locate and enhance the medical signal and/or image.		
2.5	Differentiate between different types of Histograms		
2.6	Explain linear smoothing filters and non-linear smoothing filters.		
2.7	Interpret the effect of edge detection different operators (e.g. Laplacian, Sobel and Prewitt) on the image details.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.0	**Competence** On successful completion of this course it is expected that students will be able to:		
3.1	Work effectively in groups as well as individuals.	Discuss with students. - Group presentation. - Group assignment (the instructor should meet with each group part way through project to discuss and advise on approach to the tasks). Individual student assignment or report carries out using the internet and/or library as a source of search.	Evaluation of group reports and individual contribution within the group. Peer or self assessment. Evaluation of the capacity for independent study which could be assessed in individual assignments. • .
3.2	Justify a short report in a written form and/or orally using appropriate scientific language.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments, Quizzes and Homework	Weekly	10 %
2	Class Test Exam (Two Written Tests)	6 &14	20 %
3	Mid Term Exam (practical)	--	--
4	Reports and essay (e.g. Oral Presentation, Research, and Group Project)	11	10%
5	Final Practical Exam	--	10%
6	Final Exam (Written Test)	16	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Faculty members dedicate 6 hours at least every week for office hours, during which students are encouraged to visit their instructor for help, conversation practice and clarifying difficult concepts. The Academic Management Unit also supervises a Student Support Committee that provides additional tutoring and help to weaker students or students who were registered late by the university. There is also a Special Educational Needs coordinator who helps students with special needs.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	4. Rachel A. Powsner, Edward R. Powsner, Essentials of Nuclear Medicine Physics and Instrumentation, A John Wiley & Sons, Ltd, 3rd Ed (2013). .
Essential References Materials	Medical Image Analysis journal, Elsevier Science Ltd. 6. https://www.journals.elsevier.com/medical-image-analysis/
Electronic Materials	• https://www.mathworks.com/products.html • https://imagej.net/Downloads • https://www.dartmouth.edu/~library/biomed/guides/research/medimages.html
Other Learning Materials	**1. The Microsoft Office for editing reports.** **2. The Matlab and Image J software package to train the student about how making image processing.**

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• There are enough classrooms provided with a good accommodation, including good air condition, good data show slide projector, and suitable white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show slides, Overhead projector, whiteboard, course book software, internet, speakers, printers, photocopiers, and laptops for teachers. • E-learning 2DL system. • Student correspondence system.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	• Not applicable (as the course doesn't have a laboratory section.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of Teaching	• Students • Classroom Observation • Professional Development Unit • External Reviewers such as the ASIIN Accreditation Agency	• Student Surveys • Formal Classroom Observation
Effectiveness of Assessment	• Curriculum and Test Development Unit • Curriculum Committee • Assessment Committee • External Reviewers such as the ASIIN Accreditation Agency	• Item Analysis Data • Teacher Feedback • Student Feedback • Course Reports
Extent of Achievement of Course Learning Outcomes	• Quality Assurance Unit • Curriculum and Test Development Unit	• Item Analysis Data • Course Reports • Annual Program Review

Evaluation Areas/Issues	Evaluators	Evaluation Methods

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement, of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	