



## Course Specifications

<b>Course Title:</b>	Introduction to Medical Physics
<b>Course Code:</b>	
<b>Program:</b>	Medical Path
<b>Department:</b>	Common First Year Deanship
<b>College:</b>	Applied of Medical Sciences
<b>Institution:</b>	Umm Al-Qura University

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## A. Course Identification

<b>1. Credit hours:</b>
<b>2. Course type</b>
a. University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/>
b. Required <input checked="" type="checkbox"/> Elective <input type="checkbox"/>
<b>3. Level/year at which this course is offered:</b> Common First Year
<b>4. Pre-requisites for this course (if any):</b>
None
<b>5. Co-requisites for this course (if any):</b>
none

### 6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

### 7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	20
3	Tutorial	10
4	Others (specify)	
	<b>Total</b>	75

## B. Course Objectives and Learning Outcomes

### 1. Course Description

The course aims to provide student with the basic concepts and skills of physics and to be aware of the role of physics in medicine. The course help students to understand how work some parts of the human body systems, such as the forces on muscles, bones and joints, the circulation of blood inside arteries and capillaries, the role of gravity on the blood circulation, the mechanism of human vision, the correction of the eye defects with lenses, the resting of radioactive substances in human organs and the ionizing radiation. This course, also, can help students in medicine to understand how to use some sophisticated techniques and instruments in diagnosis, therapy and surgery, such as medical imaging, radiation equipment and endoscopic surgery.

### 2. Course Main Objective

- Help students to realize the connection between physics and medicine.

- Recognize the role of physics in diagnosis and therapy through the investigation of some techniques such as X-rays, MRI, endoscope, ...
- Learn how to apply physics modeling to some parts of the human body
- Develop problem-solving and critical- thinking skills
- Improve laboratory methodology and skills in writing reports
- Acquire good communication skills in scientific presentations
- Educate students on the principles of scientific ethics.

### 3. Course Learning Outcomes

CLOs		Aligned PLOs
1	<b>Knowledge and Understanding</b>	
1.1	Define physical quantities and their standard units	
1.2	Convert quantities from a unit system to another unit system	
1.3	Identify the different types of motion	
1.4	Describe the motion from the kinematics point of view	
1.5	Solve problems of motion from the dynamics point of view, using the newton's laws of motion	
1.6	Calculate the velocity and the acceleration as vector quantities	
1.7	Calculate the range of a projectile	
1.8	State the conditions of equilibrium for a rigid body system	
1.9	Calculate the torque of a force about a pivot	
1.10	Estimate the intensity of the force applied on muscles and joints in the equilibrium conditions	
1.11	Analyze the stability of equilibrium of a rigid body	
1.12	Find the position of the center of gravity of any rigid body	
1.13	Recognize the effect of force on the shape and the size of a body	
1.15	Distinguish the main properties of fluids	
1.16	Calculate the static pressure exerted by a fluid on a solid surface	
1.17	Estimate the magnitude of the buoyant force	
1.18	Apply the continuity equation to calculate the flow rate and the velocity of fluid	
1.19	Write Bernoulli's equation and define pressure, velocity and static pressure	
1.20	Understand the effect of gravity and acceleration on the blood pressure	
1.21	Calculate viscous forces applied in fluids	
1.22	Use Poiseuille's law to estimate pressure drop in the circulatory system	
1.23	Estimate the fluid resistance in vessels and airways	
1.24	State the difference between laminar and turbulent flow.	
1.25	Recall the properties of thin lenses	
1.26	Draw the image of an object by a thin lens	
1.27	Identify the eye as an optical system	
1.28	Understand the main eye defects	
1.29	Find the appropriate power to correct an eye defect and calculate the power of the lens used to correct the defect	
1.30	Characterize the structure of the nucleus	
1.31	Explain the phenomenon of magnetic resonance of the nucleus	
1.32	Identify the different types of radioactive decay	

1.33	Calculate the effective half-life of a radionuclide in the body	
1.34	Use the exponential law to estimate radiation fractions	
1.35	Discuss the role of nuclear radiation in therapy	
1.36	Explain the interaction of radiation with tissues and biological systems	
1.37	Categorize the different types of ionizing radiation	
1.38	Specify the units of measurement in radioactivity	
1.39	Explain the meaning of source activity of a radionuclide sample	
1.40	Estimate the biological equivalent absorbed dose caused by radiations	
<b>2</b>	<b>Skills:</b>	
2.1	Perform experimental setups	
2.2	Record experimental measurements	
2.3	Plot scientific graphs	
2.4	Analyze experimental findings	
2.5	Interpret graphical illustrations	
2.6	Estimate experimental errors	
2.7	Perform accurate calculations	
2.8	Apply physics models	
2.9	Write laboratory reports	
2.10	Apply the methodology of solving problems	
<b>3</b>	<b>Values:</b>	
3.1	Appreciate the role of physics in medicine	
3.2	Build self-confidence through education	
3.3	Gain the qualities of honesty	
3.4	Develop creativity in students	

### C. Course Content

No	List of Topics	Contact Hours
1	<b>Chapter 1: Motion on a straight line</b> <ul style="list-style-type: none"> <li>▪ 1.1 Measurements, Standards and Units</li> <li>▪ 1.2 Displacements; Average Velocity</li> <li>▪ 1.3 Instantaneous Velocity</li> <li>▪ 1.4 Acceleration</li> <li>▪ 1.5 Finding the Motion of an Object</li> <li>▪ 1.6 The Acceleration of Gravity and Falling Objects</li> </ul>	6
2	<b>Chapter 2: Motion in two dimensions</b> <ul style="list-style-type: none"> <li>▪ An introduction to vectors</li> <li>▪ The velocity in two dimensions</li> <li>▪ The acceleration in two dimensions</li> </ul>	3
3	<b>Chapter 3: Newton's laws of motion</b> <ul style="list-style-type: none"> <li>▪ 3.1 -Force and weight</li> <li>▪ 3.2- Density</li> <li>▪ 3.3- Newton's 1<sup>st</sup> law</li> <li>▪ 3.4- Equilibrium</li> <li>▪ 3.5- Newton's 3<sup>rd</sup> law</li> <li>▪ 3.6- Newton's 2<sup>nd</sup> law</li> </ul>	6

	<ul style="list-style-type: none"> <li>▪ 3.8- Some Examples of Newton's Laws</li> <li>▪ 3.12- Friction</li> </ul>	
4	<b>Chapter 4: Statics</b> <ul style="list-style-type: none"> <li>▪ 4.1 Torque</li> <li>▪ 4.2 Equilibrium of rigid bodies</li> <li>▪ 4.3 The center of gravity</li> <li>▪ 4.4 Stability and balance</li> <li>▪ 4.5 Levers and mechanical advantage</li> </ul>	6
5	<b>chapter 5: Work and energy</b> <ul style="list-style-type: none"> <li>▪ 5.1 Work</li> <li>▪ 5.2 Kinetic Energy</li> <li>▪ 5.3 Potential Energy and Conservative Forces</li> <li>▪ 5.4 Power</li> </ul>	3
6	<b>Chapter 6: Fluids</b> <ul style="list-style-type: none"> <li>▪ 6.1- Pressure in fluids</li> <li>▪ 6.2- Archimedes' Principle</li> <li>▪ 6.3- The equation of continuity, Streamline flow</li> <li>▪ 6.4- Bernoulli's Equation</li> <li>6.5- Static consequence of Bernoulli's equation</li> <li>▪ 6.6- Role of gravity on the blood pressure</li> <li>▪ 6.7 Blood pressure measurement</li> </ul>	6
7	<b>Chapter 7: Non-viscous fluids</b> <ul style="list-style-type: none"> <li>▪ 7.1 Viscosity</li> <li>▪ 7.2 Flow in circulatory system</li> <li>▪ 7.3 Flow resistance</li> </ul>	3
8	<b>Chapter 8: Mirrors lenses and optical systems (2 weeks)</b> <ul style="list-style-type: none"> <li>▪ 8.1 Thin lenses</li> <li>▪ 8.2 The Power of a Lens</li> <li>▪ 8.3 The Human Eye</li> <li>▪ 8.4 Optical Defects of the Eye</li> </ul>	6
9	<b>Chapter 9: Nuclear physics</b> <ul style="list-style-type: none"> <li>▪ 9.1 Radioactivity</li> <li>▪ 9.2 Half-life</li> </ul>	3
10	<b>Chapter 10: Ionizing radiation</b> <ul style="list-style-type: none"> <li>▪ 10.1 The interaction of radiation with matter</li> <li>▪ 10.2 Radiation Units</li> </ul>	3
<b>Total</b>		45

No	List of Topics- Laboratory	Contact Hours
1	Introduction to laboratory physics	2
2	Units-Standards and conversion	2
3	Measurement of density	2
4	Torque and Rotational equilibrium of a rigid body	2
5	Surface Tension	2
6	The Simple pendulum	2
7	Resonance tube -Speed of sound	2
8	Linear thermal expansion	2
9	Measurement of viscosity	2
10	Focal length of thin lenses	2
<b>Total</b>		20

## D. Teaching and Assessment

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

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge and Understanding</b>		
1.1	All CLO's	Lectures Simulation PowerPoint presentations Tutorial sessions Seminaries  Interactive teaching Team oriented sessions	Direct questions in class Homework Short quizzes Exams
1.2			
...			
<b>2.0</b>	<b>Skills</b>		
2.1	Perform experimental setups	Assist practical work Lectures Tutorial sessions Work with small groups Small searching related to the course topics Animated discussions	Lab reports Quizzes Lab Exams Presentations Self-assessments
2.2	Record experimental measurements		
2.3	Plot scientific graphs		
2.4	Analyze experimental findings		
2.5	Estimate experimental errors		
2.6	Interpret graphical illustrations		
2.7	Perform accurate calculations		
2.8	Apply physics models		
2.9	Write laboratory reports		
2.10	Apply the methodology of solving problems		
<b>3.0</b>	<b>Values</b>		
3.1	Appreciate the role of physics in medicine	Animated discussion Team oriented sessions	Presentations Self-assessments
3.2	Build self-confidence through education		
3.3	Gain the qualities of honesty		
3.4	Develop creativity in students		

## 2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework assignments	End of each chapter	5%
2	Short Quizzes	3 to 4 quizzes per semester	10%
3	Lab reports	End of each lab session	5%
4	Lab exam	End of the semester	10%
5	Midterm Exam	Week 8	30%
6	Final Exam	End of the semester	40%

\*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 can contact instructors by e-mail and arrange appointments via official online means (blackboard- webex- Zoom,..)
- Students can visit during the office hours.
- Planning Extra lessons for revision

## F. Learning Resources and Facilities

### 1.Learning Resources

<b>Required Textbooks</b>	Physics for biology and medicine, Paul Davidovits, Third Edition, Elsevier Academic Press.
<b>Essential References Materials</b>	-General Physics, 2 <sup>nd</sup> Edition, by Morton M. Sternheim, Joseph W. Kane Wiley; (January 1991), ISBN-13: 978-0471522782. -Physics for scientists and engineering by Serway 7 <sup>th</sup> edition, Cengage Learning; (February 20, 2007). -Fundamentals of Physics: Mechanics, Relativity, and Thermodynamics (The Open Yale Courses Series), Yale University Press (December 2, 2013).
<b>Electronic Materials</b>	BlackBoard Platform
<b>Other Learning Materials</b>	<a href="https://phet.colorado.edu/">https://phet.colorado.edu/</a> <a href="https://www.myphysicslab.com/">https://www.myphysicslab.com/</a> <a href="https://onlinelabs.in/physics">https://onlinelabs.in/physics</a> <a href="https://www.omnicalculator.com/physics">https://www.omnicalculator.com/physics</a>



## 2. Facilities Required

Item	Resources
<b>Accommodation</b> (Classrooms, laboratories, demonstration rooms/labs, etc.)	
<b>Technology Resources</b> (AV, data show, Smart Board, software, etc.)	
<b>Other Resources</b> (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	Feedback - surveys
	Staff	Feedback - surveys
Assessments	Faculty and Program Leaders	Statistics analysis
LCOs achievement	Faculty	Direct evaluation
Quality of learning resources	Students and staff	Feedback - surveys

**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

<b>Council / Committee</b>	Vice Dean of Common First Year for Academic Affairs, Dr Ahmad Fawzi Arbaeen
<b>Reference No.</b>	–
<b>Date</b>	27/3/2022

