



University of Kerala

Discipline	<b>PHYSICS</b>				
Course Code	<b>UK3DSEPHY204</b>				
Course Title	<b>INTRODUCTION TO MEDICAL PHYSICS</b>				
Type of Course	<b>DSE</b>				
Semester	<b>III</b>				
Academic Level	<b>200 - 299</b>				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 Hrs	-	-	4 Hrs
Pre-requisites	<ol style="list-style-type: none"> <li>1. Concept of rotation, torque, rigid body</li> <li>2. Definition of gas pressure, equation of state, velocity of fluid and equation of continuity.</li> <li>3. Electromagnetic spectrum, properties of light: frequency, wavelength, polarization</li> </ol>				
Course Summary	<p>The course gives an understanding of biomechanical and fluid mechanical aspects of human body, in terms of motion of bones, joints etc and the blood flow along various body parts. The thermodynamical and mechanical aspects of respiration, metabolism etc are discussed. Different bio-membranes and their functionality including sound is discussed. The optical aspects of eyesight is discussed. The interaction of electro-magnetic radiation with human body and different diagnostic methods using sound and radiation are introduced.</p>				

**BOOKS FOR STUDY:**

1. Introduction to Medical Physics-Zanichelli Alessandro Bacchetta & Domenico Scannicchio - CEA (2023)

**BOOKS FOR REFERENCE:**

1. An Introduction to Medical Physics-Springer International Publishing (2017) Muhammed Maqbool (eds.)
2. Encyclopaedia of Medical Physics\_ Two Volume Set-CRC Press (2021) Slavik Tabakov, Franco Milano, Magdalena S. Stoeva, Perry Sprawls, Sameer Tipnis, Tracy Underwood

**DETAILED SYLLABUS: THEORY**

Module	Unit	Content	Hrs	CO No
<b>I</b>	<b>Biomechanics &amp; Fluid mechanics (Chapter 2&amp; 3)</b>		<b>12</b>	
	1	Introduction: muscles and bones, Torque, Rigid body equilibrium, Center of mass and center of gravity	2	1,2,3
	2	Constraints and levers, Mechanical equilibrium applied to body joints- Levers in human body, Hip joint equilibrium	2	2,3
	3	Rotational dynamics, Deformations, Deformations of bones	2	2,3
	4	Introduction: the cardiovascular system, Hydrostatic pressure and buoyancy, Liquid flow and continuity equation (No derivation)	2	1,2,3
	5	Vascular flow- Blood flow rate and velocity, Aneurysm and stenosis	2	2,3
	6	Blood viscosity, Blood pressure and resistance of vessels (No derivation), Effects of hydrostatic pressure	2	2,3
<b>II</b>	<b>Pulsation, respiration and metabolism (Chapter 4 &amp; 5)</b>		<b>12</b>	
	7	Heart, Cardiac Work & Laplace formula	2	1,2,3,4
	8	Equilibrium radius of vessels, Hydrodynamic effects of vessel dispensability	2	2,3,4
	9	Blood pressure measurements, Pulsatile motion and mechanical impedance (No derivation)	2	2,4
	10	Ideal Gas & Real Gas	1	1,2
	11	Air Composition and Respiration	1	2,4

	12	Basics only -Laws of Thermodynamics, Enthalpy, Entropy	2	4
	13	Metabolism and Spirometry	2	4
<b>III</b>	<b>Biological membranes and hearing (Chapter 6 &amp; 8)</b>		<b>12</b>	
	14	Biological Membrane, Diffusion Through Membrane (No derivation)	2	2,5
	15	Osmosis and Osmotic Pressure	2	1,5
	16	Pulmonary, digestive and kidney membranes	2	5
	17	Sound Waves, Infra sounds, Ultra Sounds	1	1
	18	Sound Sensation, Ear and the sound Transmission	1	2,5
	19	Stethoscope and the body sound,	2	5
	20	Ultra Sound in Medicine	2	7
<b>IV</b>	<b>Light and Vision (Chapter 10)</b>		<b>12</b>	
	21	Light wave Propagation, Optical Fiber, Spectrophotometry	2	1
	22	Light polarization, Light polarization and molecules optical rotatory power	2	1
	23	The microscope, Resolving power of microscope, Special Optical Microscopes	3	1
	24	The eye: sight	2	2,6
	25	The eye: vision	3	2,6
<b>V*</b>	<b>Electromagnetic &amp; Ionic radiation in medicine (Chapter 9 &amp; 11)</b>		<b>12</b>	
	26	Electromagnetic waves: spectrum, emission and absorption	2	1
	27	Electromagnetic waves in medicine	2	1
	28	X-ray imaging, CT Scan	2	1,2,7
	29	Effects of ionizing radiation in biological systems	2	1,2
	30	Diagnostics application in medicine	2	7
	31	Radiotherapy	2	7

**COURSE OUTCOMES**

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Introduce/revise concepts of physics to prepare for the study of medical physics	R	PSO-1
CO-2	Understand the human body a basic physics point of view	U	PSO-1
CO-3	Explore the mechanical and fluid dynamical aspects of body functioning	R, U	PSO-1,3
CO-4	Learn thermodynamic and mechanical aspects of respiration, metabolism etc	R, U	PSO-1,3
CO-5	Know different types of bio-membranes their functionality	U, Ap	PSO-1,3
CO-6	Introduce physical mechanism of eyesight and the related optics	R,U	PSO-1,3
CO-7	Get a clear understanding of interaction of sound, radiation with body and its diagnostic applications.	U, Ap	PSO-1,7

**R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create**

**Name of the Course: INTRODUCTION TO MEDICAL PHYSICS**

**Credits: 4:0:0 (Lecture: Tutorial: Practical)**

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Introduce/revise concepts of physics to prepare for the study of medical physics	PO1,4,6 / PSO 1	R	F	L	-
CO-2	Understand the human body a basic physics point of view	PO1,4,6 / PSO 1	U	C	L	-

CO-3	Explore the mechanical and fluid dynamical aspects of body functioning	PO1,2,3 ,4,6/ PSO 1,3	R, U	F,C	L	-
CO-4	Learn thermodynamic and mechanical aspects of respiration, metabolism etc	PO1,2,3 ,4,6/ PSO 1,3	R, U	F,C	L	-
CO-5	Know different types of bio-membranes their functionality	PO1,2,3 ,4,6/ PSO 1,3	U, Ap	F,C	L	-
CO-6	Introduce physical mechanism of eyesight and the related optics	PO1,2,3 ,4,6/ PSO 1,3	R,U	F,C	L	-
CO-7	Get a clear understanding of interaction of sound, radiation with body and its diagnostic applications.	PO1,2,4 ,5,6,8/ PSO 1,7	U, Ap	C,P	L	-

**F-Factual, C- Conceptual, P-Procedural, M-Metacognitive**

**Mapping of COs with PSOs and POs :**

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	3	-	-	-	-	-	-	2	-	-	2	-	2	-	-
CO-2	3	-	-	-	-	-	-	2	-	-	2	-	2	-	-
CO-3	3	-	2	-	-	-	-	2	2	2	2	-	2	-	-

CO-4	3	-	2	-	-	-	-	2	2	2	2	-	2	-	-
CO-5	3	-	2	-	-	-	-	2	2	2	2	-	2	-	-
CO-6	3	-	2	-	-	-	-	2	2	2	2	-	2	-	-
CO-7	3	-	-	-	-	-	3	2	2	-	2	2	-	-	2

**Correlation Levels:**

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

**Assessment Rubrics:**

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

**Mapping of COs to Assessment Rubrics:**

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	✓	-	✓
CO-2	✓	✓	-	✓
CO-3	✓	✓	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	-	✓
CO-6	✓	✓	-	✓
CO-7	✓	-	✓	✓