DEPARTMENT OF PHYSICS				*CLASS: I M.Sc. Physics*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
I	Major-Elective-2	21P1PME2	Medical Physics	4	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	✓
Skill oriented			Entrepreneurship oriented	

***Course Objectives*:**

1. To understand the general concepts in radiation and its interaction and dose measurement.
2. To apply the physics concepts in clinical trials.
3. To educate scientifically the principles of radiation and its effect in the medical field.
4. To emphasize the significance of various medical techniques and therapy.

Unit	Description	Hours	K-level	CLO
I	Basic concepts in Radiation Dosimetry: Definitions of Dosimetric Quantities-units and relationship between DQ- linear energy transfer- tissue weighting factor-charged particle equilibrium-biological effects of radiation.	15	Up to K2	**1**
II	Interaction of gamma rays and X-rays with matter: Introduction-types of interaction with matter – over all interaction of photons with matter.	15	Up to K3	**2**
III	Treatment planning in radiation therapy: photon beam treatment planning-electron beam treatment planning.	15	Up to K3	**3**
IV	Image-Guided radiation therapy: Introduction – Rationale of IGRT- current available IG techniques – traditional IGRT technologies –real time tracking systems – image registration and correction strategies – image guided Adaptive treatment (IG-ART) - management of respiratory motion.	15	Up to K3	**4**
V	Magnetic Resonance Imaging (MRI): MRI – contrasts in MRI – Physiological and functional MRI – MRI safety – future MRI applications. CT and MRI Radiotherapy: CT based treatment simulation and planning – MRI in Radiotherapy.	15	Up to K4	**5**

BOOKS FOR STUDY:

1. Introduction to Medical Physics – Muhammad Maqbool – Springer International Publishing (2017).

BOOKS FOR REFERENCE:

1. Attix FH (1986) An introduction to radiological physics and radiation dosimetry,Wiley.
   Bortfeld T, Biirkelbach J, Boesecke R, SchlegelW(1990a) Methods of image reconstruction from projections applied to conformation radiotherapy. Phys Med Biol35(10):1423–1434.
2. Adler JR Jr et al (1997) The Cyberknife: a frameless robotic system for radio Surgery StereotactFunct Neurosurg69:124–128.
3. Antonuk LEet al (1996) Megavoltage imaging with a large-area,flat-panel,amorphous silicon imager. Int J Radiat Oncol Biol Phys36:661–672.
4. Baltzer PA, Dietzel M, Kaiser WA (2012) MR-spectroscopy at 1.5 tesla and 3 tesla. Asystematic review and meta-analysis. Eur J Radiol 81(Suppl 1):S6–S9
5. Hendee WR, Ritenour ER (2002) Medical imaging physics, 4th edn. Wiley-Liss. xix, NewYork.

Web Resources:

1. https://www.ncbi.nlm.nih.gov/books/NBK230653/
2. https://en.wikipedia.org/wiki/Dosimetry
3. http://www-naweb.iaea.org/nahu/DMRP/documents/Chapter2.pdf
4. https://www.britannica.com/technology/radiation-measurement/Interactions-of-gamma-rays-and-X-rays
5. http://www.sprawls.org/ppmi2/INTERACT/
6. https://www.itnonline.com/article/introduction-current-radiation-therapy-treatment-planning-systems
7. https://pubmed.ncbi.nlm.nih.gov/1908420/
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3532745/
9. https://www.sciencedirect.com/science/article/pii/S0936655520303691
10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4435985/
11. https://aapm.onlinelibrary.wiley.com/doi/pdf/10.1118/1.4894495
    https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6404845/

Rationale for Nature of the course

This course is mainly work-related skill and essential technically the principles of radiation and its achieve in the medical field.

Activities having direct bearing on skill development/Employability / Entrepreneurship

Knowledge is to extend and highlighting the practical skill of medical field.

Pedagogy: Chalk and talk , materials, PPT, Quiz , Assignment , Seminar , Problem solving , Group discussion , interaction and field visit.

Course Designers:

1. Dr.M.Kavitha
2. Dr.J.Sivasubramanian

Lecture Schedule

Unit	Topics	Hrs	Mode
Unit I	Basic concepts in Radiation Dosimetry: Definitions of Dosimetric Quantities	**3**	PPT, Chalk and talk, Quiz and assignment
	units and relationship between DQ	**3**	
	linear energy transfer- tissue weighting factor	**3**	
	Charged particle equilibrium-biological effects ofradiation.	**4**	
	Definitions of radiation and Quantities	**2**	
Unit II	Interaction of gamma rays and X-rays with matter	**3**	Chalk and talk, Quiz and assignment
	Introduction- types of interaction with matter	**3**	
	gamma rays and X-rays	**3**	
	Photons interaction	**2**	
	All interaction of photons with matter.	**4**	
Unit III	Treatment planning in radiation therapy	**4**	Chalk and talk, Quiz, assignment and seminar
	photon beam treatment planning	**2**	
	electron beam treatmentplanning.	**4**	
	Types of interaction with matter	**3**	
	X-rays with matter	**2**	
Unit IV	Image-Guided radiation therapy	**3**	Chalk and talk, quiz, Group discussion
	(IG-ART) - management of respiratorymotion.	**2**	
	Introduction – Rationale of IGRT- current available IG techniques	**4**	
	traditional IGRT technologies –real time tracking systems	**2**	
	image registration and correction strategies – image guided Adaptive treatment (IG-ART)	**4**	
Unit V	Introduction-Magnetic Resonance Imaging (MRI)	**4**	PPT, Chalk and talk, Quiz and Interaction
	MRI – contrasts in MRI – Physiological and functional	**2**	
	MRI – MRI safety – future MRI applications	**3**	
	MRI applications. CT and MRI Radiotherapy:	**2**	
	CT based treatment simulation and planning – MRI in Radiotherapy.	**4**	

Course Learning Outcomes: On the successful completion of the course, students will be able to

CLOs	Course Learning Outcomes	Knowledge Level
CLO 1	Physics aspects of Interaction of Radiation Quantities and Units	Up to K2
CLO 2	Acquire knowledge on x –ray interaction and production.	Up to K3
CLO 3	Apply the real life application and study its radiation therapy	Up to K3
CLO 4	Discuss about the different types of particle accelerators and their medical application	Up to K3
CLO 5	Explain the different types Electromagnetic Radiation and their sources/properties	Up to K4

Mapping of CLOs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	3		2	1	3
CLO2	3			1	2
CLO3	3		2	1	2
CLO4	3	2		1	2
CLO5	3	1	2	1	3

Advance application –3, Intermediate level –2, Basic level–1

Learning Outcome Based Education (LOBE) & Assessment
Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2(K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K2	2(K2&K2)	1 (K3)
3	CLO 3	Up to K3	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
4	CLO 4	Up to K3	2	K3 & K4	1	K1	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
No. of Questions to be asked			10			5	10	5
No. of Questions to be answered			10			5	5	3
Marks for each question			1			2	5	10
Total Marks for each section			10			10	25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice
K1	2	4	10	-	**16**	13.33
K2	2	4	10	10	**26**	21.67
K3	4	2	10	20	**36**	30.00
K4	2	-	20	20	**42**	35.00
Total Marks	10	10	50	50	**120**	100.00