

INTEGRAL UNIVERSITY, LUCKNOW INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

DEPARTMENT OF PARAMEDICAL SCIENCES

MASTERS OF SCIENCE IN RADIOLOGY AND IMAGING TECHNOLOGY (M.Sc. RIT)

SYLLABUS

YEAR/ SEMESTER: I/I



Integral University, Lucknow **Department of Paramedical Sciences** Study and Evaluation Scheme

	Prog	ram: M.Sc. RIT	-									Semes	ter-I
S. Course N. code		Course Title	Type of	h	Period P r/week/s	er sem	I	Evaluatio	n Scheme		Sub. Total	Credit	Total Credits
	couc	Paper	L	<u> </u>	Р	СТ	TA	Total	ESE	Total	L	cicuits	
					THEOR	IES							
1	RT401	Radiological Physics	Core	3	1	0	40	20	60	40	100	3:1:0	4
2	RT402	Conventional Radiological and Imaging Equipment	Core	3	1	0	40	20	60	40	100	3:1:0	4
3	RT403	Radiographic and Imaging Techniques	Core	3	1	0	40	20	60	40	100	3:1:0	4
					PRACTI	CAL							
1	RT404	Residency -I Lab	Core	0	0	10	40	20	60	40	100	0:0:5	5
2	RT405	Radiological Physics -Lab	Core	0	0	8	40	20	60	40	100	0:0:4	4
3	RT406	Radiographic and Imaging Techniques- Lab	Core	0	0	8	40	20	60	40	100	0:0:4	4
		Total		09	03	26	240	120	360	240	600	25	25

c			Туре			At	tributes				United Nation	
3. N.	Course code	Course Title	of Paper	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	Development Goal (SDGs)	
		THEORIES										
1	RT401	Radiological Physics	Core	\checkmark		\checkmark					3,4	
2	RT402	Conventional Radiological and Imaging Equipment	Core	\checkmark	\checkmark	\checkmark			\checkmark	\checkmark	3,4	
3	RT403	Radiographic and Imaging Techniques	Core	\checkmark	\checkmark	\checkmark			\checkmark	\checkmark	3,4	
		PRACTICAL										
1	RT404	Residency – I Lab	Core	\checkmark	\checkmark	\checkmark			\checkmark	\checkmark	3,4	
2	RT405	Radiological Physics -Lab	Core	\checkmark	\checkmark	\checkmark			\checkmark	\checkmark	3,4	
3	RT406	Radiographic and Imaging Techniques- Lab	Core	\checkmark					\checkmark	\checkmark	3,4	

L: Lecture T: Tutorials P: Practical CT: Class Test TA: Teacher Assessment ESE: End Semester Examination, AE= Ability enhancement, DSE- Discipline Specific Elective, Sessional Total: Class Test + Teacher Assessment Subject Total: Sessional Total + End Semester Examination (ESE)



Effective from Session: 2022-23												
Course Code		RT401	Title of the Course	Radiological Physics	L	Т	Р	С				
Year		Ι	Semester	Ι	3 1 0							
Pre-Requisite		Nil	Co-requisite	Nil								
Course Objectives	To e	nsure the know	ledge of basic concept of	f Physics and radiation Physics.								
	Course Outcomes: After the successful course completion, learners will develop following attributes:											
0.04												

CO1	To study Discovery, Production, Types & Interaction with Matter.
CO2	To study about Tube & its Circuits.
CO3	To study about Radiographic Grid, Tube Cooling, Generators & Capacitor used in X-Ray Unit.
CO4	To study about X-ray generator circuits, Physical Quantity & Radiation Measurement Units.
CO5	To study about Radiation Detectors, Personal Dosimeters & Introduction to Advance Modalities.

Unit	Title of the	Content of Unit	Contact	Mapped
No.	Unit	V	Hrs.	CO
1	Introduction to X-Rays	X-rays: Discovery, production and properties, Bremsstrahlung Radiations-Characteristics X-rays, factors affecting X-ray emission spectra, X-ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets. Interaction of ionizing radiation with matter-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation. Scatter radiation its formation and control: beam centering devices, collimators, cone diaphragms and grids.	8	CO1
2	X-ray Tube History and Advancemen t	 Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number. LET, range of energy relationship for an alpha, beta particles with X-Rays. X-ray tube: historical aspects, construction of X-ray tubes, requirements for X-ray production(Electron source, target and anode material), tube voltage, current, space charge, early X-ray tubes(Coolidge tubes, tube envelop and housing) cathode assembly, X-ray production efficiency, anode angulation and rotating tubes, line focus principle, space charge effect, tube cooling, Modern X-ray tubes, stationary anode, rotating anode, grid controlled X-ray tubes, heel effect, off focus radiation, Grid-controlled and high-speed tubes, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation. 	8	CO2
3	X-Ray Tube cooling, circuit, capacitor & Rectifier	Interlocking and X-ray tube overload protection. Heat dissipation methods, tube rating, heat units and operating conditions Filament current and voltage, X-ray circuits (primary circuit, auto transformer), types of exposure switch and timers, the principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits, high frequency generators, falling load generators, Capacitors discharge and grid control systems.	8	CO3
4	Physical Quantity & Radiation Measuremen t Units	Physical quantity, its unit and measurement, Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit, KVp, mA, mAs, Heat unit (HU). Radiation quantities and units: Radiation intensity, Exposure Roentgen, its limitations, Kerma and Absorbed Dose, Electronic equilibrium, Rad, Gray, Conversion factor for Roentgen to Rad, Quality factor, Dose equivalent, REM, Sievert. Quality factor, dose equivalent, relationship between absorbed dose and equivalent dose.	8	CO4
5	Radiation Detectors, Personal Dosimeters	Radiation detection and measurements: Principle of radiation detection, Basic principles of ionization chambers, proportional counters, G.M counters and scintillation detectors. Measuring system: free ionization chamber, Thimble ion chamber, Condenser chamber, Secondary standard dosimeter, Film dosimeter, Chemical dosimeter, Thermoluminescent Dosimeter & Pocket dosimeter.	8	CO5
Refer	ence Books:			
1. Di	agnostics X-Ray	Imaging Quality Assurance by M.A. Period and P. Chaloner.		
2. 10 3. Ch	vistensen's Physi	ogy and magnig- by DavidSullon.		
4 Th	e Essentaila of Pl	hysics of Medical Imaging by Bushberg		
5. Ra	diologic Science	for Technologist by Stewart C Bushong.		
e-Le	earning Source:			
1. htt	ps://byjus.com/pl	nysics/electricity-and-magnetism/		
2. htt	ps://byjus.com/cl	nemistry/atoms-and-molecules/		
3. <u>htt</u>	ps://en.wikipedia	.org/wiki/X-ray		

		Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO	101	102	105	104	105	100	107	100	10)	1010	1011	1012	1501	1502	1505	1504
CO1	3	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
CO3	3	2	3	3	3	2	3	2	2	3	2	3	2	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	3

Course Code	Course Title			Att	ributes				SDGs
		Employability	Entropropourchin	Skill	Gender	Environment &	Human	Professional	No.
RT401	Radiological Physics	Employability	Entrepreneursnip	Development	Equality	Sustainability	Value	Ethics	
	6								3,4



Effe	Effective from Session: 2022-23									
Cou	rse Code	RT402	Title of the Course	Conventional Radiological and Imaging Equipment	L	Т	Р	С		
Year	•	Ι	Semester	I	3	1	0	4		
Pre-	Requisite	Nil	Co-requisite	Nil				•		
Cou	rse Objectives	The main objective	is to aware the student abo	but X-Ray production, Circuit & other Conventional X-Ra	y Mo	dalities.				
			Сог	irse Outcomes						
CO1	Students will be	e able to learn about I	Production of X-Rays, Grid, F	ilter & High-Tension Circuits.						
CO2	Students will be	e able to learn about M	Meters and exposure timers, Ir	nterlocking circuits & Beam Restriction Devices						
CO3	Students will be	e able to learn about f	luoroscopy & Grid.							
CO4	Students will be	e able to learn about o	components of Fluoroscopy	y, Mobile & Potable, Mammography, cranial and dental u	nits.					
CO5	Students will be	e able to learn about (General care & Maintenance o	f different Modalities.						
Unit No.	Title of the Ur	iit		Content of Unit		Contact Hrs.	Maj C	pped O		
1	Portable & Mo X-Ray Unit	bile Portable X- equipment,	Ray equipments, Mob Cordless mobile equip	bile X-Ray equipments, Capacitor discharge mob ment, X ray equipment for the operating theatre.	ile	8	CC	01		
2	Fluoroscopy U	Fluoroscop Vinit Viewing th Panel type	Fluoroscopy equipment, Construction and working principles of the image intensifier, Viewing the intensified image, Recording the intensified image, Digital fluoroscopy, Panel type image intensifier.							
3	Fluoroscopic Radiographic T & Spot Film De	ables Fluoroscop tables, The	Fluoroscopy/radiographic tables, General features of fluoroscopy / radiographic tables, The serial changer, Remote control table, The spot film devices.							
4	Digital Radiogra	aphy Computeriz radiography Equipment	ed Radiography, Digit 7, General dental x- for mammography.	tal nd	10	CC	04			
5	Darkroom Techniques	Radiograph Intensifying Radiation F Manual & A	ic film construction g Screen Construction Protection, Safe light, I Automatic Film Process	and types, Film Packaging & Safety, Casser and Maintenance, Darkroom Layout, location Pass box, Entrance of Darkroom, Developer, Fix sing, Maintenance of chemical containers.	tte, on, er,	10	CC)5		
Refe	rence Books:									
1. 0	Curry TS, Dowdey	E, Murry RC. Christ	ensen's physics of diagnos	tic cardiology. Lippincott Williams & Wilkins; 1990.						
2. E	Frant WE, Helms C	A, editors. Fundamer	tals of diagnostic radiolog	y. Lippincott Williams & Wilkins; 2012 Mar20.						
3. Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.										
4. 1 5 D	he Essentaila of Ph	iysics of Medical Ima	iging by Bushberg.							
5. K	autologic Science	for rechnologist by S	Stewart C Busnong.							
e-1	https://woutu.l	0e/R2_GR65W25w								
,	$\frac{1}{2} \frac{1}{1} \frac{1}{1} \frac{1}{2} \frac{1}$	pe/IDYG-JE16kI								
	3 https://youtu.l	pe/IhibyEnlRrM								
	<u>interpository</u> outure									

		Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
СО	101	102	105	101	105	100	10,	100	10)	1010	1011	1012	1501	1502	1505	1501
CO1	3	3	3	3	2	2	3	3	3	3	3	2	3	2	3	2
CO2	2	3	2	3	3	3	3	3	2	3	3	3	2	3	3	3
CO3	3	2	3	2	3	2	3	3	2	2	3	3	2	3	3	3
CO4	2	3	2	3	3	3	2	3	3	2	2	3	2	3	3	2
CO5	2	3	3	3	2	3	2	3	2	3	2	3	2	3	2	3

			110011540						
Course Code	Course Title			Att	ributes				SDGs
	Conventional	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional	No.
RT402	Radiological and Imaging	1	1	J	⊥quanty √	Sustainability	√aruc √	v	3,4
	Equipment	•	•	•	•		•	۲	



Effective from Session: 2022-23										
Course Code	RT403	Title of the Course	Radiographic and Imaging Techniques	L	Т	Р	С			
Year	Ι	Semester	Ι	3	1	0	4			
Pre-Requisite	Nil	Co-requisite	Nil							
Course Objectives	To impart detaile	d knowledge about diffe	erent Radiological Projection along with special Radiograph	iy Tech	niques.					

		Course Outcomes		
CO1	Students will be	able to learn about Radiography of Upper limb, Lower limb & Shoulder girdle.		
CO2	Students will be	able to learn about Radiography of Vertebral column, Pelvic girdle, Skeletal survey & Skull.		
CO3	Students will be	able to learn about Dental & Respiratory Tract Radiography.		
CO4	Students will be	able to learn about Special Projections of Thorax, Abdominal Radiography & Special Radiographic Units.		
CO5	Students will be	able to learn about Localization of foreign bodies, Operation theatre techniques & Different Mobile Radiography Tech	niques.	
Unit			Contact	Mapped
No.	Title of the Unit	Content of Unit	Hrs.	cõ
1	Radiography of Skull & Dental	Skull : Basic projections for cranium, facial bones, nasal bones and mandible. Technique for Petrous temporals for mastoids, Internal auditory canal, Accessory nasal sinuses, Tempero-mandibular joint, Orbits and optic foramen, Zygomatic arches, Styloid process, Pituitary fossa, Jugular foramen. Technique for intra oral full mouth, Occlusal projections, Extra oral projections including orthopantomography, Supplementary techniques.	10	CO1
2	Radiography of Upper & lower Limb	 Radiography of Upper Limb: Techniques for hand, fingers, thumb, wrist joint, forearm, elbow joint, humerus, shoulder joint and sternoclavicular joint. Lower Limb Techniques for foot, calcaneum, ankle joint, leg, knee joint, patella and femur (lower two thirds). 	10	CO2
3	Radiography of Pelvic Girdle & Vertebral Column	Pelvic Girdle Techniques for pelvis, ilium, ischium and pubic bone, Techniques for hip joint and sacroiliac joint. Vertebral Column Techniques for Atlanto, occipital articulation, cervical vertebrae, cervical-thoracic junction, thoracic vertebrae, lumbar vertebrae, lumbo-sacral articulation, sacrum and coccyx.	7	CO3
4	Vertebral, Thoracic & Abdominal Radiography	Respiratory System Techniques for lungs, various views erect and lying, bones of thorax, techniques for sternum and upper lower ribs. Gastro Intestinal system Techniques for routine abdomen and radiographs on acute conditions. Excretory system Techniques for KUB and radiographs on acute conditions.	7	CO4
5	Other Radiographic Techniques	Macroradiography: Principle, advantage, technique and applications. Stereography: Procedure, presentation, for viewing, stereoscopes. High KV techniques: Principle and its applications. Bedside Radiography Soft tissue Radiography Localization of foreign bodies: Various techniques Operation theatre techniques Trauma radiography/Emergency radiography Neonatal and Pediatric Radiography	6	CO5
Refere	ence Books:			
1 W	nitley AS, Jefferson	G, Holmes K, Sloane C, Anderson C, Hoadley G. Clark's Positioning in Radiography 13E. CRC Press; 2015 J	ul 28.	
2 Bo	ntrager KL, Lampig	nano J. Textbook of Radiographic Positioning and Related Anatomy-E-Book. Elsevier Health Sciences; 2013	Aug 7.	
3 Bo	ntrager KL, Lampig	nano J. Bontrager's Handbook of Radiographic Positioning and Techniques-E-BOOK. Elsevier Health Science	ces; 2017]	Feb 10.
4 Fra	ank ED, Long BW, S	mith BJ. Merrill's Atlas of Radiographic Positioning and Procedures-E-Book. Elsevier Health Sciences; 2013	Aug 13.	
e-Le	arning Source:			
1	. https://www.slid	leshare.net/InfoUtilRT/upper-extremity-anatomy-positioning		
2	https://voutu.be	/LIStHhk5e9w		

3. https://youtu.be/C2Ud4EwZVQM

				•	Course	Articu	lation	Matrix	: (Mapp	oing of C	COs with	POs an	d PSOs)			
PO-PSO	PO1	PO2	PO3		PO5	POG	PO7	POS	POQ	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO/
СО	101	102	105	104	105	100	107	100	109	1010	1011	1012	1501	1502	1305	1304
CO1	3	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
CO3	3	2	3	3	3	2	3	2	2	3	2	3	2	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	3

Course Code	Course Title			Att	ributes				SDGs
RT403	Radiographic and	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.
	Imaging Techniques	1	4	4	1		1	1	3,4



Effect	ive fron	n Sessi	on: 202	2-23												
Cours	Course CodeRT404Title of the CourseResidency - I LabLTPCYearISemesterI00105															
Year			Ι		Semest	ter					Ι			0	0	10 5
Pre-R	equisite	•	Ni	1	Co-req	uisite					Nil					
Cours	e Objec	tives	The ol departr	ojective nent.	of the	Resider	icy Lab	is to le	earn abo	ut patient	handling,	radiation	protection	and proc	edures do	ne in the
			Cours	e Outco	omes: At	fter the s	successfi	ul cours	e comple	tion. learne	ers will de	velop follo	wing attrib	outes:		
CO1	Stude	nts will	be able t	o learn	how to c	leal with	a patie	nt during	g examin	ation in the	Radiolog	y departme	ent.			
CO2	Stude	nts will	be able t	o learn	how to p	perform	X-Ray E	Examina	tions.							
CO3	Stude	nts will	be able t	o learn	how to p	perform	contrast	studies	along wi	th their pre	paration a	nd manage	ement.			
CO4	Stude	nts will	be able t	o learn	how to p	perform	ward me	bile rad	liography	on critica	lly ill patie	ents.				
CO5	Stude	nts will	be able t	o learn	how to p	perform	CT scan	s, MRI,	Fluorosc	opy and M	lammogra	phy.				
Unit No.	Titl	e of the	e Unit					Conte	nt of Ur	nit			Cont	act Hrs.	Мар	ped CO
1	Course ContentsIn the residency the professional is expected to work and contribute in the medical imaging unit.CO1, CO2, CO3, CO4, CO5														201, 202, 203, 204, 205	
Refere	ence Bo	oks:														
1. Se	eeram E.	Compu	ted Tom	ography	y-E-Bool	k: Physi	cal Princ	ciples, C	linical.							
2. A	pplicatio	ns and (Quality C	Control.	Elsevier	Health	Science	s; 2015	Sep 2.							
3. L	akhkar B	N, Ban	avali S,	Shetty (C. Radio	logical c	quiz-hea	d and ne	eck. India	n Journal o	of Radiolo	gy and Ima	iging.			
4. Si	nopek Al	M. Fund	amentals	s of Spe	cial Rad	iographi	ic Procee	dures-E-	Book. El	sevier Hea	Ith Scienc	es; 2013 A	ug 13.	0		
5. Ci	arry IS, I	Dowdey Holms	JE, Mu	rry RC.	Christer	isen's pr	iysics of	diagnos	stic cardio	ology. Lipp	me & Wil	liams & W	/11k1ns; 195	0.		
0. Bi	viebel W	T Soha	$\sim A, euto$	roductio	on to ultr	asound	WB Sai	unders (y. Lippin	1998		KIIIS, 2012	Iviai 20.			
8. H	agen-Ans	s, sona	Textbool	c of dia	gnostic u	ltrasono	graphy.	Mosby	Elsevier:	2006.						
e-L of	orning S.	ourco					8r-J.									
1. https	://en.wik	ipedia o	rg/wiki/	High-re	solution	compu	ted tom	ography								
2. https	://youtu.l	be/Ihjbv	EnlRrM		sorution	compu		ogrupny								
3. https	://en.wik	ipedia.o	rg/wiki/	Doppler	r_ultraso	nograph	iy									
					Cours	e Artic	ulation	Matri	x: (Mar	ning of (Os with	POs and	PSOs)			
PO-										P-ing of (- 05 414	1000)			
PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO																
CO1	2	3	2	2	1	2	1	1	1	1	3	1	2	3	3	2
CO2	2 3 2 2 1 2 1 1 1 3 1 2 3 3 2 1 3 2 2 2 1 3 2 1 3 3 2 2 3 3 2															

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation A 44----0 600

CO3

CO4

CO5

			Attribu	tes & SDGs					
Course Code	Course Title			Att	ributes				SDGs
		Employability	Entrepreneurship	Skill	Gender	Environment &	Human	Professional	No.
RT404	Residency Lab- I	Linpioyaointy	Lincpreneursnip	Development	Equality	Sustainability	Value	Ethics	
-	J								3,4



Effective from Session, 2022 22

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CO4

CO5

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Ellecuv	Interview if only session: 2022-25										
Course	Code	RT405	Title of the Course	Radiological Physics -Lab	L	Т	Р	С			
Year		Ι	Semester	Ι	0	0	8	4			
Pre-Req	luisite	Nil	Co-requisite	Nil							
Course	Objectives	To ensure the know	ledge of basic concept of I	Physics and radiation Physics.							
	Course Outcomes: After the successful course completion, learners will develop following attributes:										
CO1	To study abou	at Discovery, Product	tion, Types & Interaction v	vith Matter.							
CO2	To study abou	ıt X-ray Tube & its C	Circuits.								
CO3	To study abou	t Radiographic Grid	, Tube Cooling, Generators	s & Capacitor used in X-Ray Unit.							
CO4	To study abou	it X-ray generator cir	cuits, Physical Quantity &	Radiation Measurement Units.							
CO5	To study abou	at Radiation Detector	s, Personal Dosimeters &	Introduction to Advance Modalities.							

Title of the Mapped Unit Contact **Content of Unit** No. Unit Hrs. CO X-rays: Discovery of x-rays-X-ray production and properties. 1. 2. Interaction of ionizing radiation with matter. 3. Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number. Radiation intensity and exposure, photon flux and energy flux density. 4. 5. LET, range of energy relationship for alpha, beta particles with X-Rays. 6. X-ray tube: historical aspects, construction of X-ray tubes, requirements for X-ray CO1, production (Electron source, target and anode material), tube voltage, current, space Course CO2, charge, early X-ray tubes (Coolidge tubes, tube envelop and housing) cathode assembly. 1 80 CO3, Contents 7. Grid controlled and high-speed tubes, focal spot size, speed of anode rotation, target angle, CO4, inherent filtration, radiation leakage and scattered radiation). Interlocking and X-ray tube CO5 overload protection. 8. X-ray generator circuits. 9. Radiation quantities and units: Radiation intensity, Exposure Roentgen, its limitations, Kerma and Absorbed Dose, Electronic equilibrium, Rad, Gray, Conversion factor for Roentgen to Rad, Quality factor, Dose equivalent, REM, Sievert. Quality factor, dose equivalent, relationship between absorbed dose and equivalent dose 10. Film dosimeter, Chemical dosimeter, Thermoluminescent Dosimeter & Pocket dosimeter. **Reference Books:** 1. Diagnostics X-Ray Imaging Quality Assurance by M.A. Period and P. Chaloner. 2. Textbook of Radiology and imaging- by DavidSutton. 3. Christensen's Physics of diagnostic radiology. 4. The Essentaila of Physics of Medical Imaging by Bushberg. 5. Radiologic Science for Technologist by Stewart C Bushong. e-Learning Source: https://byjus.com/physics/electricity-and-magnetism/ https://byjus.com/chemistry/atoms-and-molecules https://en.wikipedia.org/wiki/X-ray Course Articulation Matrix: (Mapping of COs with POs and PSOs) PO-PSO PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1 PSO₂ PSO3 PSO4 CO 3 3 3 3 3 3 3 3 3 3 2 3 3 2 3 3 CO1 3 3 3 3 3 3 3 3 3 3 3 3 3 2 3 3 **CO2** 3 2 3 2 2 3 3 2 3 2 3 3 3 CO3 2 3 3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation Attributes & SDGs

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Course Code	Course Title			At	tributes				SDGs
		Employability	Entrementership	Skill	Gender	Environment &	Human	Professional	No.
RT405	Radiological Physics -Lab	Employability	Entrepreneursnip	Development	Equality	Sustainability	Value	Ethics	
	8 ,	4	√	1	4		1	4	3,4

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Effective from Session: 20	2022-23						
Course Code I	RT406	Title of the Course	Radiographic and Imaging Techniques- Lab	L	Т	Р	С
Year	Ι	Semester	Ι	0	0	8	4
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	To impart	detailed knowledge about of	different Radiological Projection along with special Radiography Tec	hniqu	es.		

	Course Outcomes
CO1	Students will be able to learn about Radiography of Upper limb, Lower limb & Shoulder girdle.
CO2	Students will be able to learn about Radiography of Vertebral column, Pelvic girdle, Skeletal survey & Skull.
CO3	Students will be able to learn about Dental & Respiratory Tract Radiography.
CO4	Students will be able to learn about Special Projections of Thorax, Abdominal Radiography & Special Radiographic Units.
CO5	Students will be able to learn about Localization of foreign bodies, Operation theatre techniques & Different Mobile Radiography Techniques.

Unit No.	Tit	tle of th	ne Unit							Conten	t of Unit					Contact Hrs.	Mapped CO
1	List	of Pı	actic	al	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	Skele a. U b. I c. S d. V e. I f. S Denta Uppe Radio Warc Macr Stere High Soft 1 Loca Oper	etal sys Upper Lower Should Vertebr Pelvic Skull al Radi r respi Dgraph I mobil oradio ograph KV te tissue I lization ation t	stem: limb limb er gird ral colu girdle a iograph ratory y of Tl le Radio graphy y chniqu Radiog n of for heatre	le umn and hip tract horax a iograph 7 res raphy reign b technic	o region & Abdon 1y podies 1ues	nen					80	CO1, CO2, CO3, CO4, CO5
Referen	ce Book	s:		TT 1	17 (1)	<u></u>	1 (- TT 11	0.01	11 0 11	· · Þ	1. 1 .		20151	1.1.0.0		
1 V	Vhitley A	AS, Jeffe	erson G,	Holmes	K, Sloan	e C, An	derson (2, Hoadl	ey G.Cla	ted Apator	oningin Rad	diography . Elsevier H	3E. CRC P	ress; 2015 J	Jul 28.		
3 Bon	trager K	L, Lamp	ignano l	I. Bontra	ager's Ha	indbook	of Radi	ographic	Positio	ning and To	echniques-F	E-BOOK, El	sevier Heal	th Sciences:	: 2017 Feb	10.	
4 Fran	ik ED, Lo	ong BW,	Smith B	J. Merri	ll's Atlas	ofRadio	graphic	Position	ing and	Procedures	-E-Book. E	Elsevier Hea	alth Science	s; 2013 Aug	g 13.		
e-Lear	rning Sou	urce:															
1. <u>htt</u>	ps://www	w.slides	hare.net	/InfoUti	IRT/upp	er-extren	nity-ana	tomy-po	ositionin	g							
2. <u>htt</u>	ps://yout	$\frac{10.0e/Ll}{10.0e}$	StHnk5e	9 <u>w</u> ZVOM													
<u>.</u>	ps.//you	14.00/02	Cu+Lw														
DO F			[1		[Cours	se Artici	lation	viatrix: (N	Lapping of	COs with	POs and Pa	50s)			
PO-F	SU)	PO1	PO2	PO3	3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1 PSO2 PSO												PSO4
CO)1	3	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
CO	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
CC	03	3	2	3	3 3 2 3 2 2 3 2 3 2 3 3												3
CC	94	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3
CC	95	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

			Attribu	tes & SDGs					
Course Code	Course Title			Att	ributes				SDGs
RT406	Radiographic and Imaging	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.
	Techniques- Lab			Ý					3,4, 11



INTEGRAL UNIVERSITY, LUCKNOW INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

DEPARTMENT OF PARAMEDICAL SCIENCES

MASTERS OF SCIENCE IN RADIOLOGY AND IMAGING TECHNOLOGY (M.Sc. RIT)

SYLLABUS

YEAR/ SEMESTER: I/II



Integral University, Lucknow Department of Paramedical Sciences Study and Evaluation Scheme

Program: M.Sc. RIT Semester-II												er-II	
S.	Course	Course Title	Type	Per hr/w	riod Pe veek/se	r em		Evalu	ation Scl	heme	Sub. Total	Credit	Total
IN.	code	Course The	of Paper	L	Т	Р	СТ	ТА	Total	ESE		creat	Credits
THEORIES													
1	RT407	Radiation Safety and Protection	Core	3	1	0	40	20	60	40	100	3:1:0	4
2	RT408	Modern Radiological and Imaging Equipment	Core	3	1	0	40	20	60	40	100	3:1:0	4
3	RT409	Radiological and Imaging Procedures	Core	3	1	0	40	20	60	40	100	3:1:0	4
				PRA	CTICAL								
1	RT410	Residency – II Lab	Core	0	0	10	40	20	60	40	100	0:0:5	5
2	RT411	Modern Radiological and Imaging Equipment –Lab	Core	0	0	8	40	20	60	40	100	0:0:4	4
3	RT412	Radiological and Imaging Procedures – Lab	Core	0	0	8	40	20	60	40	100	0:0:4	4
Total 09 03 26 240 120 360 240 600 25											25	25	

S.	Course		Type			At	ributes				United Nation Sustainable
N.	code	Course Title	of Paper	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	Development Goal (SDGs)
TH	EORIES										
1	RT407	Radiation Safety and Protection	Core	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark	3,4
2	RT408	Modern Radiological and Imaging Equipment	Core	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark	3,4
3	RT409	Radiological and Imaging Procedures	Core	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark	3,4
PRA	CTICAL										
1	RT410	Residency – II Lab	Core	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark	3,4
2	RT411	Modern Radiological and Imaging Equipment -Lab	Core	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark	3,4
3	RT412	Radiological and Imaging Procedures – Lab	Core	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark	3,4

 L: Lecture
 T: Tutorials
 P: Practical
 CT: Class Test
 TA: Teacher Assessment
 Ese: End Semester Examination,

 AE= Ability enhancement, DSE- Discipline
 Specific Elective, Sessional Total: Class Test + Teacher Assessment
 Subject Total: Sessional Total + End Semester Examination (ESE)

Effective from Session	: 2022-23							
Course Code	RT407	Title of the Course	Radiation Safety and Protection	L	Т	Р	С	
Year	Ι	Semester	П	3	1	0	4	
Pre-Requisite	Nil	Nil Co-requisite Nil						
Course Objectives	The purpose of technological app of machines. In action to enable them log	this course is to pulications. This course ddition, the course is of gically tackle complex	rovide an understanding of physical concepts and also provides fundamental idea about circuit analysi expected to develop scientific temperament and analy a engineering problems in their chosen area of applica	unde s, wor tical s tion.	erlying king p kill in	vario rincipl studen	us les ts,	

	Course Outcomes
CO1	Students will be able to learn about radiation safety in diagnostic Radiology.
CO2	Students will be able to learn about Measurement and Biological Effects of Radiation.
CO3	Students will be able to learn about Radiation Protection & Planning Consideration for Radiology.
CO4	Students will be able to learn about Regulatory Bodies of Radiology and Their Guidelines.
CO5	Students will be able to learn about Newer Radiation Safety Protocols & Role Of Radiology Staff In Different Aspects Of Work.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Biological Effects of Radiation	Biological aspects of Radiological protection, biological effects of radiation, Direct and indirect actions of radiation, concept of detriment-Documentation and stochastic effect of radiation-somatic and general effects, Dose relationship, Effects of antenatal exposure.	8	CO1
2	Introduction to Radiation Protection	Introduction to Radiation Protection, Need for Protection, Aim of Radiation Protection, Basic radiation units and qualities, Exposure, Absorbed dose equivalent, Quality factor, Tissue weighting factor.	8	CO2
3	Radiation Limitation Factors	Limits of Radiation exposure, Concept of ALARA (or ALARP), ICRP regulation, Maximum permissible dose, Exposure in pregnancy, children, Protection in Diagnostic Radiology, Protection for primary radiation, Work load, Use factor, Occupancy Factor, Protection in scatter Radiation and leakage radiation, X-Ray room design, Structural shielding, Protective devices, Radiation sign ages.	8	CO3
4	Technical Radiation Protection in Different Examination	Technical protective considerations during Radiography, Evaluation of hazards, Effective communication, Immobilization, Beam limiting devices, Filtration, Exposure factors, Protection in- Fluoroscopy, mammography, mobile radiography, CT scan, Angiography room.	8	CO4
5	Regulatory Bodies of Radiology and Their Guidelines	Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements. (ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection). NABH guidelines, AERB guidelines, PNDT Act and guidelines.	8	CO5

Reference Books:

1. 5	Sherer MA, Visconti PJ, Ritenour ER, Haynes K. Radiation Protection in Medical Radiography-E-Book. Elsevier Health Sciences; 2014Mar12.
2. E	Brandon AN, Hill DR. Selected list of books and journals in allied health. Bulletin of the Medical LibraryAssociation,1996.

3. Long BW, Frank ED, Ehrlich RA. Radiography Essentials for Limited Practice-E-Book. Elsevier Health Sciences; 2016 Sep6

Durrani SA, IlicR, editors. Radon measurements by etched track detectors: applications in radiation protection, earth sciences and the environment. World scientific
 Turner JE. Atoms, radiation, and radiation protection. John Wiley & Sons; 2008Jan8

e-Learning Source:

1. https://en.wikipedia.org/wiki/Radiation_protection

2. <u>https://youtu.be/mvjYRGjrKHc</u>

3. <u>https://www.slideshare.net/RubiSapkota/radiation-protection-and-personnel-monitoring-devices</u>

		Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
СО	1															
C01	3	3	3	3	2	2	3	3	3	3	3	3	2	2	3	3
CO2	2	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3
CO3	3	3	3	2	3	3	3	3	2	2	3	3	2	2	2	3
CO4	3	3 2 3 2 3 3 2 3 3 3 2 2														
CO5	2	3	3	3	2	3	2	3	2	2	2	3	2	3	2	3
	1 Low Convolution, 2 Moderate Convolution, 3 Substantial Convolution															

Course Code	Course Title		Attributes						
RT407	Radiation Safety and	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.
	Protection	4	4	4	*		1	4	3,4



Effect	tive from S	Session	: 2022	2-23						- ·								
Cours	se Code]	RT408	Т	Title of th	e Cours	se N	loder r	n Radio	<u>logi</u> ca	l and Im	aging Eq	uipme	nt	L	Τ	P C
Year				Ι	S	emester					II					3	1	0 4
Pre-R	lequisite			Nil	C	Co-requis	ite				Nil							
Cours	se Obiecti	ve	The p	ourpose of	f this c	ourse is	to provi	ide an	unders	standing	g of ph	ysical cor	ncepts and	d unde	rlying v	ariou	s techn	ological
			applic	cations of	advan	ce moda	lities of	f radio	logy de	epartme	nt.							
CO1	Studer	nts will	be able	e to learn :	about M	lodern & S	pecial Ra	Cot adiology	Irse Out	comes								
CO2	Studer	ts will	be able	e to learn a	about T	omography	y, Tomos	ynthesis	, DSA a	nd Beam	Restrict	tion Devices	5.					
CO3	Studer	nts will	be able	e to learn a	about Fl	luoroscopy	& CT sc	can.	,									
CO4	Studer	nts will	be able	e to learn a	about U	SG & MR	I.											
CO5	Studer	nts will	be able	e to learn	about M	IR Spectro	scopy and	d Nuclea	ar Imagi	ng Techn	iques.							
Unit No.	Title of	the Uni	t						Conter	nt of Unit						Co	ontact Hrs.	Mapped CO
]	Готоgra	phy: I	Body see	ction ra	adiogra	aphy, I	basic p	rincipl	e and eq	uipment,	multi	section	L		
	T		t	omograp	hy, var	ious type	es of top	pograp	phic mo	ovemen	ts,							
	Tomog	graphy	7,]	Tomosynthesis, Stitch radiography														
1	1 omosy & Vo	onulor	¹⁸ , I	DEXA scan (Dual energy x-ray absorptiometry).										8	CO1			
	a va Ima	ocuiai oring	V	Vascular	Imagi	ing Equ	ipment	t: Intr	oductio	on, hist	orical	developm	nents DS.	A Equ	ipment,			
	1114	5	F	Principle,	applic	cations a	nd defi	inition	of ter	ms, Sin	gle Pla	ane, Bipl	ane, Hyb	rid DS	SA Lab,			
			Ι	Digital Subtraction Techniques.														
			τ	Ultrason	ograph	ny: Basi	c princ	iple of	f U.S,	various	s types	s of trans	sducers, 1	necha	nism of			
			i	mage for	mation	n, variou	s advai	nceme	nts inc	luding	Doppl	ler, Elasto	ography.	HIFU.	ABVS			
2	U	SG	а	and image artifacts											8	CO2		
	Ċ,	00	T	Doppler USG: Principle, Doppler Effect, Color Doppler Continuous wave Doppler											U	002		
			F	Pulsed wa	ve Doi	nnler	, 2°-		,	00101	2 opp				oppier,			
			N	Mammon	raphy	Equipme	nt· X l	Pav T	uba Fi	iltor Co	mnra	ssion Day	vice Filte	rs Go	nerator			
3	Mamm	ograp	hy	Viaininog	onsole. Digital Mammography & Common view of Mammography											8	CO3	
				Computed Tomography: Principle data acquisition concepts image reconstruction											_			
						nograpi	iy : Prii	ncipie,		acquis	uon (concepts,	image r	econsi	ruction,			
			11	spiral/halical single slice/multiclica CT Electron beem CT mobile CT Advences in														
4	СТ	Scan	s	spiral/nencal, single slice/multislice U1, Electron beam U1, mobile U1, Advances in										8	CO4			
			V	volume scanning, continuous sub-second scanning. Real time CT fluoroscopy,														
			i	interventional guidance tool, 3D CT, CT angiography.														
			1	Virtual re	ality in	naging, i	ncludin	ng imag	ge qual	lity and	qualit	y control	in CT Sca	anners	•			
			N	MRI: Ba	sic prir	nciple of	MRI, o	comple	ete ima	iging eq	luipme	ent and va	arious req	uirem	ents, T1			
			a	and T2	Relaxat	tion beh	aviors	of tis	ssues,	T1, T2	and	proton d	lensity in	nages,	spatial			
-		п	1	ocalizatio	on of i	images,	Types	of im	aging	sequen	ces (sp	pin echo,	fast spin	n echo	o, flash,		0	005
5	IVI	KI	i	nversion	recove	ry, gradi	ient ech	o etc.									8	05
			Ν	MR spect	roscop	y, princi	ple and	techni	iques, (Contras	t Agen	nts in MR	I, Image	quality	, Image	:		
			a	rtifacts a	rtifacts and its compensators, NMR hazard and safety & Advancement.													
Referen	nce Books:		- -															
1. Th	e physics of	radiolo	gy and i	imaging by	K Thaya	alan.	ios of 1		40 di -1-	**								
2. Cu 3. Tu	cker AK. N	g YY. Te	xtbook	of mammos	raphy. C	Churchill L	ivingston	e; 2001	radiolog	у.								
4. We	entz G, Pars	ons WC	. Mamn	nography fo	or radiolo	ogic techno	ologists. I	McGraw	v-Hill,He	ealth Prof	essions	Division; 19	97					
5. Zw	viebel WJ, S	ohaey R	. Introd	luction to u	ltrasound	d. WB Sau	nders Co	mpany;	1998.									
e-Lea	e-Learning Source:																	
$\frac{1}{2}$ h	ups://WWW. ttns://www	radiolog	vinfo o	org/en/info/	nammo	0201/319												
3. h	ttps://en.wil	kipedia.	org/wik	i/Doppler_1	ltrasonc	ography												
							Corr	rse Artion	lation Mat	riv: (Monri	ng of CO-	with POc and	PSOs)					
P).PSO						Cour	.se Araca	auon wiat									
P	C0	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO	2	PSO3	PSO4
	CO1	3	3	3	3	2	2	3	3	3	3	3	2	2	2		3	3
	CO2	3	2	3	2	3	2	3	3	2	2	3	3	2	3		3	3
	CO4	2	3	2	3	3	3	2	3	3	2	3	3	2	3		3	2
		2	5	1- Low	Correlatio	on; 2- Moder	ate Correlat	tion; 3- Su	ibstantial	Correlation			5			1	2	5
Cou	rse Code		Course	e Title					Attribute	s & SDGs	Attril	butes	_					SDGs No.
R	T408	Modern Radiolo		ological and	F	Employability Entrepreneurship Skill Development Gender Equality Environment & Sustainability Human				Profess	sional Ethics							
1		In	Imaging Equipmer			4 4 4 4				4	1	4	3,4					



Effective	e from Ses	ssion: 2022-2	3									
Course	Code	<u>R'I'4</u>	UY	Title of the Course	Radiological and Imaging Procedures			C				
Year	• •,	<u> </u>		Semester		3	0	4				
Pre-Reg	luisite		· 1	Co-requisite		<u> </u>		1.24				
Objectiv	NOC	The objective	and special p	ontrast-imaging techniq	les under the guidance of fluoroscopy, the administration of ology Department	of contrast	media an	a its				
Objectiv	vcs	salety aspect	and special p		ology Department.							
001	G. 1 .		1 1 .	C	Course Outcomes							
<u>CO1</u>	Students	will be able t	o learn about	Contrast media used in	Radiology and their reactions along with management.							
CO2	Students	will be able t	o learn about	the barium procedures	of the GIL.							
<u>CO3</u>	Students	will be able t	o learn about	Singgraphy CNS proc	adure Arthrography Angiography & Venography							
C04 C05	Students	will be able t	o learn about	microbiology and its b	ranches							
005	Brudents	will be uble t		meroororogy and its of	Tuteries.							
Unit No.	Title of	f the Unit			Content of Unit	Contac Hrs.	t Maj C	pped O				
1	Introd Sp Proce Contra	luction to becial edures & ast Media	Patient Preparation, Indications, Contraindications, Technique, After Care and Preparation of Drug Trolley/Tray. Contrast Media: Positive and Negative, Ionic & Non – Ionic, Adverse Reactions to Contrast Media and Patient Management, Emergency Drugs in the Radiology Department, Aseptic technique.									
2	Proce GIT, 5 Gla Biliary	edure of Salivary nd and y System	Gastroint Hypotonic studies; C Including US and M Biliary cholangiog (ERCP), Cholangiog	astrointestinal Tract: Barium Swallow, Barium Meal and Follow Through, ypotonic Duodenography, Small Bowel Enema, Barium Enema, Double Contrast udies; Colostomy. Special techniques for specific disease to be examined. cluding water soluble contrast media - eg. Gastrograffin Studies. Including CT, S and MRI Special Imaging Techniques.8S and MRI Special Imaging Techniques. tolangiography (PTHC), Endoscopic retrograde cholangio-pancreatography ERCP), Operative Cholangiography, Post-Operative cholangiography (T-tube holangiography), Including CT, US and MRI Special Imaging Techniques.								
3	Proce Urinar Bre Salivar	edure of y System, east & ry Glands	Urinary Cystograp Imaging T Salivary g Breast Im	system: IVU, Re hy and MCU, Urethr echniques. glands: Routine techn aging: Mammograp	trograde Pyelography, Antegrade Pyelography, ography (RGU), Including CT, US and MRI Special nique, procedure - sialography. hy: Basic views, special views, wire localization.	8	C	03				
4	Proce Reproc Resp Systen	edure of ductive & biratory n & DCG	Reproduct reproducti Respirato Imaging T Dacryocy	tive system: All ve system including I ry system: - Brond echniques. stography.	the Techniques relating to Male and Female Hysterosalpingography. chography: Including CT, US and MRI Special	8	C	04				
5	Sinogra Proce Arthr	aphy, CNS edure & ography	Sinograph Central M including Arthrogra Special Im	Sinography: Routine technique and procedure. Central Nervous System: Myelography, Cerebral studies, Ventriculography etc including CT, US and MRI Special Imaging Techniques. Arthrography: Shoulder, Hip, Knee, Elbow joints etc including CT, US and MRI Special Imaging Techniques.								
Referen	ce Books:											
1. Lakhk	ar B N, Ba	anavali S, She	tty C. Radiol	ogical quiz-head and ne	eck. Indian Journal of Radiology and Imaging.							
2. Snope	k AM. Fur	ndamentals of	Special Radi	ographic Procedures-E-	-Book. Elsevier Health Sciences: 2013 Aug 13.							
3. Davie	s SG, Char	oman S. Aids	to radiologica	al differential diagnosis.	Elsevier Health Sciences; 2013 Nov 20.							
4. Krishr	namurthy,	Medical Radi	ographic Tec	hnique & Darkroom Pra	ictice							
5. Anant	hanarayar	n R. and Pani	ker C.K.J. (2	2009) Textbook of Mici	robiology. 8thedition, University Press Publication.							
e-Lear	ning Sour	rce:										
1. https	s://youtu.be/	/IYfL-V2C9Uw	1									
2. <u>https</u>	s://youtu.be/	/zY12G2Z_T7N	1									
-												

		Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO	101	102	105	104	105	100	107	100	10)	1010	1011	1012	1501	1502	1505	1504
CO1	3	3	3	3	2	2	3	3	3	3	3	2	3	2	3	2
CO2	2	3	2	3	3	3	3	3	2	3	3	3	2	3	3	3
CO3	3	2	3	2	3	2	3	3	2	2	3	3	2	3	3	3
CO4	2	3	2	3	3	3	2	3	3	2	2	3	2	3	3	2
CO5	2	3	3	3	2	3	2	3	2	3	2	3	2	3	2	3

Course Code	Course Title		Attributes						SDGs
RT 400	Radiological and	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.
K1409	Imaging Procedures	1	1	√	lquanty	Sustainability	value √	Lunes √	3,4



			2 m (01 51 0 j) = d 0 m 0 ()							
Effective from Sess	Effective from Session: 2022-23									
Course Code	RT410	Title of the Course	Residency – II Lab	L	Т	Р	С			
Year	Ι	Semester	Π	0	0	10	5			
Pre-Requisite	Nil		Nil							
Course Objectives	The objective of the department.	the Residency Lab is	to learn about patient handling, radiation protection a	nd pro	ocedure	es done	e in			

	Course Outcomes: After the successful course completion, learners will develop following attributes:
CO1	Students will be able to learn how to deal with a patient during examination in the Radiology department.
CO2	Students will be able to learn how to perform X-Ray Examinations.
CO3	Students will be able to learn how to perform contrast studies along with their preparation and management.
CO4	Students will be able to learn how to perform ward mobile radiography on critically ill patients.
CO5	Students will be able to learn how to perform CT scans, MRI, Fluoroscopy and Mammography.

Unit	Title of the Unit	Content of Unit	Contact	Mapped									
N0.			Hrs.	CO									
				CO1,									
		In the residency the professional is expected to work and contribute in the		CO2,									
1	Course Contents	medical imaging unit	80	CO3,									
				CO4,									
				CO5									
Refere	Reference Books:												
1. Se	1. Seeram E. Computed Tomography-E-Book: Physical Principles, Clinical.												
2. Ap	2. Applications and Quality Control. Elsevier Health Sciences; 2015 Sep 2.												
3. La	khkar B N, Banavali S, Sh	etty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging	g.										
4. Sn	opek AM. Fundamentals of	f Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 1	3.										
5. Cu	rry TS, Dowdey JE, Murr	y RC. Christensen's physics of diagnostic cardiology. Lippincott Williams & Wilki	ns; 1990.										
6. Bra	ant WE, Helms CA, editor	s. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Ma	r20.										
7. Zw	viebel WJ, Sohaey R. Intro	duction to ultrasound. WB Saunders Company;1998.											
8. Ha	gen-Ansert SL. Textbook	of diagnostic ultrasonography. Mosby Elsevier; 2006.											
e-Lea	e-Learning Source:												
1. http	1. https://en.wikipedia.org/wiki/High-resolution_computed_tomography												
2. http	ps://youtu.be/IhjbvEnlRrN	1											

3. https://en.wikipedia.org/wiki/Doppler_ultrasonography

		Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO/	PO5	PO6	PO7	POS	POQ	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO/
СО	101	102	105	104	105	100	107	100	10)	1010	1011	1012	1501	1502	1505	1504
CO1	2	3	2	2	1	2	1	1	1	1	3	1	2	3	3	2
CO2	1	3	2	2	2	1	3	2	1	3	3	2	2	2	3	3
CO3	2	3	3	2	2	3	1	2	1	1	3	2	2	3	3	3
CO4	1	3	2	1	3	1	3	3	1	3	3	3	2	1	3	2
CO5	2	3	1	1	1	1	2	1	1	2	3	1	2	2	3	2
				1 T	C	- 41	1 M.	1	n	4	C-1-4	4-1 C	-1-4			

Course Code	Course Title		Attributes												
RT410	Residency – II Lab	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics							
	j 11 2wo	\checkmark	\checkmark				\checkmark	\checkmark	3,4						



Effective from Sessi	Effective from Session: 2022-23													
Course Code	RT411	Title of the Course	Modern Radiological and Imaging Equipment –Lab	L	Т	Р	С							
Year	Ι	Semester	II	0	0	8	4							
Pre-Requisite	Nil	Co-requisite	Nil											
Course Objectives	The purpo	ose of this course is	to provide an understanding of practical concepts an	d uno	derlying	vari	ous							
Course Objectives	technologi	echnological applications of advance modalities of radiology department.												

	Course Outcomes										
CO1	Students will be able to learn about Modern & Special Radiology Equipments.										
CO2	Students will be able to learn about Tomography, Tomosynthesis, DSA and Beam Restriction Devices.										
CO3	Students will be able to learn about Fluoroscopy & CT scan.										
CO4	Students will be able to learn about USG & MRI.										
CO5	Students will be able to learn about MR Spectroscopy and Nuclear Imaging Techniques.										

Unit	Title of the Unit	Content of Unit	Contact	Mapped							
No.	List of Practical	 Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of topographic movements, Tomosynthesis, Stitch radiography DEXA scan. Vascular Imaging Equipment: Introduction, historical developments DSA Equipment Computed Tomography Ultrasonography Ultrasonography Transducers of USG MRI Contrast Agents in MRI, Image quality, Image artifacts and its compensators, NMR hazard and safety. Advances in MRI. 	Hrs. 80	CO1, CO2, CO3, CO4, CO5							
		11. Radionuclide scanning including rectilinear scanner, gamma camera, PET, SPECT, their principles, working, applications and advancements.									
Refer	ence Books:										
1. The	e physics of radiolog	y and imaging by K Thayalan.									
2. Cu	rry TS, Dowdey JE,	Murray RC. Introduction to the physics of diagnostic radiology.									
3. Tu	3. Tucker AK, Ng YY. Textbook of mammography. Churchill Livingstone; 2001.										
4. Wentz G, Parsons WC. Mammography for radiologic technologists. McGraw-Hill, Health Professions Division; 1997											
5. Zwiebel WJ, Sohaey R. Introduction to ultrasound. WB Saunders Company;1998.											
e-Le	arning Source:										

1. https://www.slideshare.net/shreyacathe/ct-scan-62017319

2. <u>https://www.radiologyinfo.org/en/info/mammo</u>

3. https://en.wikipedia.org/wiki/Doppler_ultrasonography

		Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	POS	POQ	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO	101	102	105	104	105	100	107	100	109	1010	1011	1012	1501	1502	1505	1504
CO1	3	3	3	3	2	2	3	3	3	3	3	2	2	2	3	3
CO2	2	3	2	2	3	3	3	3	2	3	3	2	2	3	3	3
CO3	3	2	3	2	3	2	3	3	2	2	3	3	2	3	3	3
CO4	2	3	2	3	3	3	2	3	3	2	3	3	2	3	3	2
CO5	2	3	3	3	2	3	2	3	2	3	2	3	2	3	2	3

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs													
Course	Course Course Title Attributes												
Code													
PT /11	Modern Radiological	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics					
K1411	–Lab			Ń	A F				3,4, 11				



Effective from Sessi	Effective from Session: 2022-23												
Course Code	RT412	Title of the Course	Radiological and Imaging Procedures – Lab	L	Т	Р	С						
Year	Ι	Semester	II	0	0	8	4						
Pre-Requisite	NIL	Co-requisite	Nil										
Course Objectives	The objective is to learn contrast-imaging techniques under the guidance of fluoroscopy, the administration of												
Course Objectives	contrast media	contrast media and its safety aspect and special procedures done in Radiology Department.											

	Course Outcomes
CO1	Students will be able to learn about Contrast media used in Radiology and their reactions along with management.
CO2	Students will be able to learn about the barium procedures of the GIT.
CO3	Students will be able to learn about the procedures of the Urinary system, HSG and hepatobiliary procedures.
CO4	Students will be able to learn about Sinography, CNS procedure, Arthrography, Angiography & Venography.
CO5	Students will be able to learn about microbiology and its branches.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO					
1	List of Practical	 Contrast Media Emergency Drugs in the Radiology Department Gastrointestinal Tract Salivary glands: Routine technique, procedure - sialography Biliary system: (ERCP). Operative cholangiography, post-Operative cholangiography (T-tube Cholangiography). Urinary system Reproductive system Breast Imaging Respiratory system Sinography: Routine technique and procedure. Central Nervous System Arthrography Angiographic Studies Venography 	80	CO1, CO2, CO3, CO4, CO5					
Refere	nce Books:								
1. Lakl	nkar B N, Banavali S,	Shetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.							
2. Snop	pek AM. Fundamenta	ls of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13	•						
3. Dav	ies SG, Chapman S. A	Aids to radiological differential diagnosis. Elsevier Health Sciences; 2013 Nov 20.							
4. Kris	hnamurthy, Medical	Radiographic Technique & Darkroom Practice							
5. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8thedition, University Press Publication.									
e-Learning Source:									
1. <u>htt</u>	ps://youtu.be/lYfL-V2	<u>2C9Uw</u>							
2 http	nav//wantu ha/zV12C2								

https://youtu.be/zYl2G2Z_T7M 2.

https://www.britannica.com/technology/microscope 3.

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO- PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO																
CO1	3	3	3	3	2	2	3	3	3	3	3	2	3	2	3	2
CO2	2	3	2	3	3	3	3	3	2	3	3	3	2	3	3	3
CO3	3	2	3	2	3	2	3	3	2	2	3	3	2	3	3	3
CO4	2	3	2	3	3	3	2	3	3	2	2	3	2	3	3	2
CO5	2	3	3	3	2	3	2	3	2	3	2	3	2	3	2	3

Course Code	Course Title	Attributes							SDGs No.
RT412	Radiological and Imaging Procedures –	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
	Lab				\checkmark		\checkmark		3,4