

# INTEGRAL UNIVERSITY, LUCKNOW

INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

**DEPARTMENT OF PARAMEDICAL SCIENCES** 

MASTERS OF MEDICAL RADIOLOGICAL IMAGING SCIENCES

(MMRIS)

**SYLLABUS** 

YEAR/ SEMESTER: I/I



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

	<b>Program:</b>	MMRIS										Semester-I	
S.	Course	Course Title	Type of		Period Pe r/week/sei		]	Evaluation	n Scheme		Sub.	Credit	Total Credits
14.	code	Course Thie	Paper	L	Т	Р	СТ	TA	Total	ESE	Total	Crean	
					THE	ORIES							
1	RS501	Radiological Physics	Core	3	1	0	40	20	60	40	100	3:1:0	4
2	RS502	Conventional Radiological and Imaging Equipment	Core	3	1	0	40	20	60	40	100	3:1:0	4
3	RS503	Radiographic and Imaging Techniques	Core	3	1	0	40	20	60	40	100	3:1:0	4
					PRAC	TICAL							
1	RS504	Residency – I Lab	Core	0	0	10	40	20	60	40	100	0:0:5	5
2	RS505	Radiological Physics - Lab	Core	0	0	8	40	20	60	40	100	0:0:4	4
3	RS506	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

S	~		Туре			А	ttributes				United Nation Sustainable
5. N.	Course code	Course Title	of Paper	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	Development Goal (SDGs)
		THEORIES									
1	RS501	Radiological Physics	Core	$\checkmark$		$\checkmark$			$\checkmark$		3,4
2	RS502	Conventional Radiological and Imaging Equipment	Core	$\checkmark$		$\checkmark$			$\checkmark$		3,4
3	RS503	Radiographic and Imaging Techniques	Core	$\checkmark$		$\checkmark$			$\checkmark$		3,4
		PRACTICAL									
1	RS504	Residency – I Lab	Core	$\checkmark$		$\checkmark$			$\checkmark$		3,4
2	RS505	Radiological Physics -Lab	Core	$\checkmark$		$\checkmark$			$\checkmark$		3,4
3	RS506	Radiographic and Imaging Techniques- Lab	Core	$\checkmark$		$\checkmark$					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)



			megrur								
Effectiv	e from Session: 2023	3-24									
Course	Code	RS501	Title of the Course	Radiological Physics	L	Т	Р	С			
Year		Ι	3	1	0	4					
Pre-Req	quisite	Nil	Co-requisite	Nil							
Course	Objectives To e	nsure the know	ledge of basic concept o	f Physics and radiation Physics.							
	0	0.4	4 C - 1 - C 1								
	Cou	rse Outcome	es: After the successful c	course completion, learners will develop following attributes:							
CO1	To study Discovery	, Production, T	ypes & Interaction with	Matter.							
CO2	To study about Tub	e & its Circuits									
CO3	To study about Radiographic Grid, Tube Cooling, Generators & Capacitor used in X-Ray Unit.										
CO4	To study about X-ra	y generator cir	cuits, Physical Quantity	& Radiation Measurement Units.							
CO5	To study about Rad	iation Detector	s, Personal Dosimeters &	& Introduction to Advance Modalities.							

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.       8         1       INTRODUCTION TO X-RAYS       Interaction of ionizing radiation with matter-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation.       8         2       Exponential attenuation its formation and control: beam centering devices, collimators, cone diaphragms and grids.       8	CO1
Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and	
2 <b>X-RAY TUBE</b> HISTORY AND ADVANCEMENTatomic 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)8ADVANCEMENTspace charge, early 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.	CO2
3X-RAY TUBE COOLING, CIRCUIT, CAPACITOR & RECTIFIERInterlocking 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
4PHYSICAL QUANTITY & RADIATION MEASUREMENT UNITSPhysical 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
5RADIATION DETECTORS, PERSONAL DOSIMETERSRadiation 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
Reference Books:	
<ol> <li>Diagnostics X-Ray Imaging Quality Assurance by M.A. Period and P. Chaloner.</li> <li>Textbook of Radiology and imaging- by DavidSutton.</li> </ol>	

Textbook of Radiology and imaging- by DavidSutton.
 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:

<u>https://byjus.com/physics/electricity-and-magnetism/</u>
<u>https://byjus.com/chemistry/atoms-and-molecules/</u>
<u>https://en.wikipedia.org/wiki/X-ray</u>

						Cours	e Artic	ulation	Matrix: (	Mapping	of COs wi	th POs and	PSOs)			
PO- PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
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

			Allibu						
Course Code	Course Title			Att	ributes				SDGs
RS501	Radiological Physics	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.
				$\checkmark$			$\checkmark$	$\checkmark$	3,4



Effective from Session: 2022-23         General Region         Description         Descrint         Description										
Cou	rse Code	RS502	Title of the Course	Conventional Radiological and Imaging Equipment	L	Т	Р	С		
Year	•	Ι	Semester	Ι	3	1	0	4		
Pre-	Requisite	Nil	Co-requisite	Nil						
Cou	rse Objectives	The main object	ive is to aware the student abo	out X-Ray production, Circuit & other Conventional X-Ray	Mod	lalities.				
Unit No.	Title of the U	nit		Content of Unit		Contact Hrs.		oped O		
1	PORTABLE X-RAY			Mobile X-Ray equipments, Capacitor discharge mobile equipment, X ray equipment for the operating theatre.		8	CO	D1		
2	FLUOROSCO	OPY UNIT		struction and working principles of the image intensifier, e, Recording the intensified image, Digital fluoroscopy, Pa	inel	8	CO	)2		
3	FLUOROS RADIOGRAPH & SPOT FIL	HIC TABLES	Fluoroscopy/radiographic tal tables, The serial changer, Re		6	CO	)3			
4	DIGITAL RADIOGRAP		Computerized Radiography, radiography, General denta Equipment for mammography		10	CO	)4			
5	DARKROO TECHNIQU	M	Radiographic film construct Intensifying Screen Construct Radiation Protection, Safe lig Manual & Automatic Film Pr	te, on,	10	CO	)5			
	rence Books:									
				ic cardiology. Lippincott Williams & Wilkins; 1990.						
				y. Lippincott Williams & Wilkins; 2012 Mar20.						
<ol> <li>Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.</li> <li>The Essentaila of Physics of Medical Imaging by Bushberg.</li> </ol>										
			Imaging by Bushberg. by Stewart C Bushong.							
	Learning Source:	for recinologist i	by Stewart C Busilolig.							
C-1		be/R2-GB65Wa5v	V							
2 https://youtu.be/JDYG-JEl6kI										
		be/IhjbvEnlRrM								
L										

		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	100	10.	100	100	10/	100	10/	1010	1011	1012	1001	1002	1500	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

Course Code	Course Title			At	tributes				SDGs
RS502	Conventional Rediclogical and Imaging	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.
K3302	Radiological and Imaging Equipment	$\checkmark$	$\checkmark$	$\checkmark$	V		$\checkmark$	$\checkmark$	3,4



Effective from Session: 2	2023-24						
Course Code	RS503	Title of the Course	Radiographic and Imaging Techniques	L	Т	Р	С
Year	I	Semester	I	3	1	0	4
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	To impart detaile	d knowledge about diffe	rent Radiological Projection along with special Radiography	/ Techi	niques.		

**Course Outcomes** CO1 Students will be able to learn about Radiography of Upper limb, Lower limb & Shoulder girdle. CO<sub>2</sub> 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. Students will be able to learn about Special Projections of Thorax, Abdominal Radiography & Special Radiographic Units. **CO4** Students will be able to learn about Localization of foreign bodies, Operation theatre techniques & Different Mobile Radiography Techniques **CO5** Contac Unit Mappe Title of the Unit **Content of Unit** t Hrs. d CO No. Skull: Basic projections for cranium, facial bones, nasal bones and mandible. Technique for Petrous temporals for mastoids, Internal auditory canal, Accessory nasal sinuses, Tempero-RADIOGRAPHY mandibular joint, Orbits and optic foramen, Zygomatic arches, Styloid process, Pituitary fossa, 1 10 CO1 **OF SKULL &** Jugular foramen. DENTAL Technique for intra oral full mouth, Occlusal projections, Extra oral projections including orthopantomography, Supplementary techniques. **Radiography of Upper Limb:** Techniques for hand, fingers, thumb, wrist joint, forearm, elbow joint, humerus, shoulder joint RADIOGRAPHY and sternoclavicular joint. 10 2  $CO^2$ **OF UPPER &** Lower Limb LOWER LIMB Techniques for foot, calcaneum, ankle joint, leg, knee joint, patella and femur (lower two thirds). Pelvic Girdle RADIOGRAPHY Techniques for pelvis, ilium, ischium and pubic bone, Techniques for hip joint and sacroiliac OF PELVIC joint. 7 3 GIRDLE & CO3 Vertebral Column VERTEBRAL Techniques for Atlanto, occipital articulation, cervical vertebrae, cervical-thoracic junction, COLUMN thoracic vertebrae, lumbar vertebrae, lumbo-sacral articulation, sacrum and coccyx. **Respiratory System** Techniques for lungs, various views erect and lying, bones of thorax, techniques for sternum VERTEBRAL, THORACIC & and upper lower ribs. 4 ABDOMINAL **Gastro Intestinal system** 7 CO<sub>4</sub> Techniques for routine abdomen and radiographs on acute conditions. RADIOGRAPHY Excretory system Techniques for KUB and radiographs on acute conditions. Macroradiography: Principle, advantage, technique and applications. Stereography: Procedure, presentation, for viewing, stereoscopes. High KV techniques: Principle and its applications. Bedside Radiography OTHER 5 RADIOGRAPHIC Soft tissue Radiography 6 CO5 TECHNIQUES Localization of foreign bodies: Various techniques Operation theatre techniques Trauma radiography/Emergency radiography Neonatal and Pediatric Radiography **Reference Books:** 1 Whitley AS, Jefferson G, Holmes K, Sloane C, Anderson C, Hoadley G. Clark's Positioningin Radiography 13E. CRC Press; 2015 Jul 28.

Whitley AS, Jefferson G, Holmes K, Sloane C, Anderson C, Hoadley G. Clark's Positioningin Radiography 13E. CRC Press; 2015 Jul 28.
 Bontrager KL, Lampignano J. Textbook of Radiographic Positioning and Related Anatomy-E-Book. Elsevier Health Sciences; 2013 Aug 7.
 Bontrager KL, Lampignano J. Bontrager's Handbook of Radiographic Positioning and Techniques-E-BOOK. Elsevier Health Sciences; 2017 Feb 10.
 Frank ED, Long BW, Smith BJ. Merrill's Atlas of Radiographic Positioning and Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.
 e-Learning Source:

1. <u>https://www.slideshare.net/InfoUtilRT/upper-extremity-anatomy-positioning</u>

 2.
 https://youtu.be/LIStHhk5e9w

 3.
 https://youtu.be/C2Ud4EwZVQM

						Course	e Articu	lation I	Matrix:	(Mapping of	f COs with	n 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	104	105	100	10/	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
	1- Lov	v Corre	elation;	2- Mod	lerate	Correla	ntion; 3	- Subst	tantial (	Correlation	Attributes	& SDGs				
Course Code	•	Cou	ırse Titl	e		Attributes S										SDGs
RS503	RS503 Radiographic and Imaging Techniques				Emp	loyability	Ent	repreneur	ship	Skill Development	Gender Equality		onment & inability	Human Value	Professional Ethics	No.
1.0000	I	naging	g Techr	iques				$\checkmark$		Ń	1			$\checkmark$	$\checkmark$	3,4



Effectiv	ve from Sessi	on: 2023-24											
Course	e Code	RS504	Title of the Course	Residency - I Lab	L	Т	P	С					
Year		Ι	Semester	Ι	0	0	10	5					
Pre-Re	re-Requisite Nil Co-requisite Nil												
Course	Objectives The objective of the Residency Lab is to learn about patient handling, radiation protection and procedures done in the department.												
		Course Out	comes: After the successful co	ourse 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 Exam	inations.									

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 No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	COURSE CONTENTS	In the residency the professional is expected to work and contribute in the medical imaging unit.	80	CO1, CO2, CO3, CO4, CO5

#### **Reference Books:**

Tffeeding fuene Consigns 2022 24

1.	Seeram E. Computed Tomography-E-Book: Physical Principles, Clinical.
2.	Applications and Quality Control. Elsevier Health Sciences; 2015 Sep 2.

Applications and Quarty Control. Ensevier fream Sciences, 2015 Sep 2.
 Lakhkar B N, Banavali S, Shetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.

Snopek AM. Fundamentals of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.

Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic cardiology. Lippincott Williams & Wilkins; 1990.

6. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.

7. Zwiebel WJ, Sohaey R. Introduction to ultrasound. WB Saunders Company;1998.

8. Hagen-Ansert SL. Textbook of diagnostic ultrasonography. Mosby Elsevier;2006.

e-Learning Source:

1. <u>https://en.wikipedia.org/wiki/High-resolution\_computed\_tomography</u>

2. https://youtu.be/IhjbvEnlRrM

3. https://en.wikipedia.org/wiki/Doppler\_ultrasonography

					Cou	ırse Ar	ticulat	ion Ma	ntrix: (N	<b>Iapping</b>	of COs v	vith POs	and PSO	s)		
PO- PS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
0	roi	102	105	104	105	100	10/	100	103	1010	ron	1012	1301	1302	1303	1304
СО																
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

Course Code	Course Title			Att	ributes				SDGs
RS504	Residency Lab- I	Employability	Entrepreneursh ip	Skill Developme nt	Gender Equalit y	Environment & Sustainability	Huma n Value	Professional Ethics	No.
		$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$	$\checkmark$	3,4



Effectiv	e from Session	: 2023-24						-					
Course	Code	RS505	Title of the Course	Radiological Physics -Lab	L	Т	Р	С					
Year		Ι	Semester	Ι	0	0	8	4					
Pre-Rec	quisite	Nil	Co-requisite	Nil									
Course	Course Objectives To ensure the knowledge of basic concept of Physics and radiation Physics.												
		<u>C</u>											
		Course Outcome	es: After the successful cot	urse completion, learners will develop following attributes									
CO1	To study abou	at Discovery, Product	tion, Types & Interaction w	vith Matter.									
CO2	To study about	ut X-ray Tube & its C	Circuits.										
CO3	To study abou	ut Radiographic Grid	, Tube Cooling, Generators	s & Capacitor used in X-Ray Unit.									
CO4	04 To study about X-ray generator circuits, Physical Quantity & Radiation Measurement Units.												
CO5	O5 To study about Radiation Detectors, Personal Dosimeters & Introduction to Advance Modalities.												

Unit No.		of the nit							(	Content o	f Unit					Contact Hrs.	Mapped CO
						1.	X-ra	ys: Dis	covery	of x-rays-	X-ray pro	duction ar	nd propertie	es.			
							2	. Inte	raction	of ionizir	g radiatio	n with ma	tter.				
				3. Ex	ponent								Value Thic atomic nui	kness (HV nber.	T), Tenth		
										-			ergy flux d				
									-	-	-		cles with X	-			
				(E	ray tub lectron	e: histo source,	orical a target	spects, and and	construction construction construction construction construction construction construction construction constru	uction of erial), tub	X-ray tu	bes, requi current, s	rements for	or X-ray p ge, early X			
1	COU CONT	URSE FENT	S	inl pro	herent f	iltratior	n, radia							tation, tar X-ray tube		80	CO1, CO2, CO3, CO4,
					ray gen												CO4, CO5
						Kerma and		005									
						n to Rad,											
				Quality factor, Dose equivalent, REM, Sievert. Quality factor, dose equivalent, relationsl between absorbed dose and equivalent dose													
											oluminesc	ent Dosii	meter &	Pocket			
					simeter		chem	icui uo	Simeter	, 111011110	Juliliese			locket			
Referer	nce Books:	:		uo													
	gnostics X							od and P	. Chalon	er.							
	tbook of R																
	istensen's																
	Essentaila																
	rning Sou		or rech	noiogist	by Stew	ансы	snong.										
	tps://byjus.		vsics/el	ectricity	-and-ma	gnetism/											
	s://byjus.c																
3. <u>http</u>	s://en.wiki	pedia.o	rg/wiki	/X-ray													
							Cour	se Artic	ulation	Matrix: (N	Apping of	f COs with	POs and P	SOs)			
PO-I	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
C	0	FUI	PO2	POS	P04	POS	P00	P0/	P08	P09	1010	POIT	P012	1301	P302	P305	P304
CC	01	3	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
CC	-	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
CC		3	2	3	3	3	2	3	2	2	3	2	3	2	3	3	3
CC	-	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3
CC	)5	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	3

ſ	Course Code	Course Title		Attributes S												
	RS505	Radiological Physics -Lab	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.						
		<u> </u>	$\checkmark$	$\checkmark$	$\checkmark$	V		V	$\checkmark$	3,4						



Effective from Session	: 2023-24						
Course Code	RS506	Title of the Course	Radiographic and Imaging Techniques- Lab	L	Т	Р	С
Year	I	Semester	I	0	0	8	4
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	To impar	t detailed knowledge about o	different Radiological Projection along with special Radiography Tec	hnique	s.		

	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	le of th	he Unit							Conter	nt of Unit					Contact Hrs.	Mapped CO
1		LIST ACT	OF		<ol> <li>Skeletal system:         <ul> <li>Upper limb</li> <li>Lower limb</li> <li>Lower limb</li> <li>Shoulder girdle</li> <li>Vertebral column</li> <li>Pelvic girdle and hip region</li> <li>Skull</li> </ul> </li> <li>Dental Radiography</li> <li>Upper respiratory tract</li> <li>Radiography of Thorax &amp; Abdomen</li> <li>Ward mobile Radiography</li> <li>Macroradiography</li> <li>High KV techniques</li> <li>Soft tissue Radiography</li> <li>Localization of foreign bodies</li> <li>Operation theatre techniques</li> </ol>											80	CO1, CO2, CO3, CO4, CO5
	ice Books					-											
														ress; 2015 J			
														es; 2013 Au th Sciences;		0	
	0	· 1	0		0			0 1		0	1			s; 2013 Aug			
	rning Sou																
	ps://www ps://youtu				RT/uppe	-extrem	ity-anato	my-posi	tioning								
	ps://youti ps://yout																
	1						Cour	se Artic	ulation	Matrix: (N	Apping of	<sup>°</sup> COs with	POs and P	SOs)			
PO-P	so				201	205				,				1	DECO	Prop	Dict
C		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO	)1	3	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
CO		3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3
CO	-	3	2	3	3	3	2	3	2	2	3	2	3	2	3	3	3
CO		3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3
CO	05	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	3

Course Code	Course Title		Attı	ibutes				SDGs
RS506	Radiographic and Imaging Techniques-	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.
	Lab							3,4, 11



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

## **DEPARTMENT OF PARAMEDICAL SCIENCES**

## **MASTERS OF RADIOLOGICAL IMAGING SCIENCES**

## (MMRIS)

## **SYLLABUS**

## YEAR/ SEMESTER: I/II



#### Integral University, Lucknow Department of Paramedical Sciences <u>Study and Evaluation Scheme</u>

	Program: MMRIS												ster-II		
S.	Course	Course Title	Туре	hr/w	<sup>.</sup> iod Per eek/sem			Evalua	ation Sch		Sub. Total	Credit	Total		
N.	code	Course Title	of Paper	L T		Р	СТ	ТА	Total	ESE		Credit	Credits		
	THEORIES														
1	1RS507Radiation Safety and ProtectionCore310402060401003:1:0														
2	RS508	Modern Radiological and Imaging Equipment	Core	3	1	0	40	20	60	40	100	3:1:0	4		
3	RS509	Radiological and Imaging Procedures	Core	3	1	0	40	20	60	40	100	3:1:0	4		
				PRAG	CTICAL										
1	RS510	Residency – II Lab	Core	0	0	10	40	20	60	40	100	0:0:5	5		
2	RS511	Modern Radiological and Imaging Equipment -Lab	Core	0	0	8	40	20	60	40	100	0:0:4	4		
3	RS512	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		

S.	Course		Туре			A	ttributes				United Nation Sustainable
N.	Course code	Course Title	of Paper	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	Development Goal (SDGs)
TH	EORIES										
1	RS507	Radiation Safety and Protection	Core			$\checkmark$	V		$\checkmark$		3,4
2	RS508	Modern Radiological and Imaging Equipment				$\checkmark$			$\checkmark$		3,4
3	RS509	Radiological and Imaging Procedures	Core			$\checkmark$					3,4
PRA	CTICAL										
1	RS510	Residency – II Lab	Core			$\checkmark$	V		V		3,4
2	RS511	Modern Radiological and Imaging Equipment - Lab	Core			$\checkmark$	V		V		3,4
3	RS512	· · · · · ·				$\checkmark$			V		3,4
3     RS512     Radiological and Imaging Procedures – Lab     Core $$ $$ $$ $$											

 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
 Total: Class Test + Teacher Assessment
 Subject Total: Sessional Total + End Semester Examination (ESE)



......

Effective from Session	: 2023-24						
Course Code	RS507	Title of the Course	<b>Radiation Safety and Protection</b>	L	Т	Р	С
Year	Ι	Semester	П	3	1	0	4
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	technological app of machines. In a	lications. This course ddition, the course is	rovide an understanding of physical concepts and e also provides fundamental idea about circuit analysi expected to develop scientific temperament and analy x engineering problems in their chosen area of applica	is, wor vtical s	rking p	orincip	les

	Course Outcomes							
CO1	Students will be able to learn about radiation safety in diagnostic Radiology.							
CO2	O2 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	INTRODUCTIO N 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	3 <b>RADIATION</b> <b>FACTORS</b> 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.										
4	TECHNICAL RADIATION         Technical protective considerations during Radiography, Evaluation of hazards, Effective										
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							
	ce Books:										
1. Sher	rer MA, Visconti PJ, Ri Indon AN, Hill DR, Select	itenour ER, Haynes K. Radiation Protection in Medical Radiography-E-Book. Elsevier Health Scier red list of books and journals in allied health. Bulletin of the Medical LibraryAssociation,1996.	nces; 2014M	lar12.							
3. Long BW, Frank ED, Ehrlich RA. Radiography Essentials for Limited Practice-E-Book. Elsevier Health Sciences; 2016 Sep6											
4. Durrani SA, IlicR, editors. Radon measurements by etched track detectors: applications in radiation protection, earth sciences and the environment. World scientific											
		n, and radiation protection. John Wiley & Sons; 2008Jan8									
	rning Source: ps://en.wikipedia.org/wi	iki/Radiation protection									
	ps://youtu.be/mvjYRGji										
		7RubiSankota/radiation-protection-and-personnel-monitoring-devices									

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

		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
CO1	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	2	3	3	2	3	- 3	3	3	2	2
CO5	CO5         2         3         3         2         3         2         3         2         2         3															
	1- Low Correlation: 2- Moderate Correlation: 3- Substantial Correlation Attributes & SDGs															

				- ,				13	
Code	Course Title			Att	ributes				SDGs
RS507	Radiation Safety and Protection	Employability	Entrepreneurship	Skill Develop ment	Gend er Equal ity	Environm ent & Sustainab ility	Hum an Val ue	Professional Ethics	No.
		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$	3,4



T.ff.	dine from Consta	2022 24	Integrai	University, Lucknow			_		
	ctive from Sessio	r	Tidle of the Course	Modorn Dodiological and Imaging Equipment	r m	п	C		
Year	rse Code	RS508	Title of the Course Semester		L <b>T</b> 3 1	<b>P</b> 0	C		
					3 1	0	4		
Pre-	Requisite	Nil	Co-requisite	Nil	• • 1	1 .	1		
Cour	se Objective			an understanding of physical concepts and underlying va	rious techr	ologic	cal		
		applications of adv	vance modalities of rad	Course Outcomes					
CO1	Students wi	ll be able to learn abou	t Modern & Special Radiol						
CO2				esis, DSA and Beam Restriction Devices.					
CO3			t Fluoroscopy & CT scan.						
CO4	Students will	ll be able to learn abou	t USG & MRI.						
CO5	Students will	ll be able to learn abou	t MR Spectroscopy and Nu	clear Imaging Techniques.					
Unit No.	Title of the U	nit		Content of Unit	Contact Hrs.	Map CC			
		Tomography	y: Body section radi	ography, basic principle and equipment, multi section					
		tomography,	various types of topogra	phic movements,					
	TOMOGRAI		sis, Stitch radiography						
1	TOMOSYNI	THES DEXA scan	(Dual energy x-ray absor	rptiometry).	0	co	11		
1	IS, &	Vascular Im	aging Equipment: Intro	oduction, historical developments DSA Equipment, Principle,	8	CO	71		
	VASCULA IMAGIN	1	and definition of terms,	Single Plane, Biplane, Hybrid DSA Lab, Digital Subtraction					
	IMAGIN	Techniques.	,						
			aphy: Basic principle	of U.S, various types of transducers, mechanism of image					
		formation, various advancements including Doppler, Elastography, HIFU, ABVS and image							
		artifacts.				СО			
2	USG		G: Principle, Doppler Ef	fect, Color Doppler, Continuous wave Doppler,	8		12		
		Pulsed wave							
				Tube, Filter, Compression Device, Filters, Generator,					
3	MAMMOGI	RAP Control cor	sole, Digital Mamm	ography & Common view of	8	CO	13		
5	HY	Mammograph	ıy.		0		.5		
		Commuted	Tomography Dringi	nla data acquisition concents image reconstruction					
		instrumentati		ple, data acquisition concepts, image reconstruction, lation, Historical developments, Various generations,					
				CT, Electron beam CT, mobile CT, Advances in volume					
4	CT SCAN	-	-	anning. Real time CT fluoroscopy, interventional guidance	8	СО	14		
4	CI SCAP		CT angiography.	anning. Real time C1 hubioscopy, incrventional guidance	0		/4		
			0011	ge quality and quality control in CT Scanners.					
				lete imaging equipment and various requirements, T1 and T2					
				T2 and proton density images, spatial localization of images,					
				ho, fast spin echo, flash, inversion recovery, gradient echo etc.					
5	MRI	• •		niques, Contrast Agents in MRI, Image quality,	8	CO	)5		
2	WIN	-		NMR hazard and safety & Advancement.	Ũ	00			
D - f	man Daabar	8							
	ence Books: he physics of radiol	logy and imaging by K Th	navalan.						
			on to the physics of diagnos	stic radiology.					
3. Ti	icker AK, Ng YY. T	Fextbook of mammograph	y. Churchill Livingstone; 20	01.					
				raw-Hill,Health Professions Division; 1997					
	wiebel WJ, Sohaey arning Source:	K. Introduction to ultrasc	ound. WB Saunders Compar	IY,1770.					
	-	are.net/shreyacathe/ct-sca	n-62017319						
		ogyinfo.org/en/info/mamm							
		.org/wiki/Doppler_ultraso							

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

Code	Course Title			Att	ributes				SDGS No.
RS508	Modern Radiological and	Employability	Entrepreneurship	Skill Development	Equalit y	Sustainabilit	Huma n Value	Professional Ethics	
	Imaging	$\checkmark$		$\checkmark$					3,4
	Equipment								



Effective from Sessio	n: 2023-24						
Course Code	RS509	Title of the Course	<b>Radiological and Imaging Procedures</b>	L	Т	Р	С
Year	Ι	Semester	П	3	1	0	4
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives			chniques under the guidance of fluoroscopy, the administration in Radiology Department.	tion o	f contra	ist med	ia

	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	INTRODUCTION TO SPECIAL PROCEDURES & CONTRAST MEDIA	<ul> <li>Special Radiographic/Radiological procedures, Responsibility of radiographers, Patient Preparation, Indications, Contraindications, Technique, After Care and Preparation of Drug Trolley/Tray.</li> <li>Contrast Media: Positive and Negative, Ionic &amp; Non–Ionic, Adverse Reactions to Contrast Media and Patient Management, Emergency Drugs in the Radiology Department, Aseptic technique.</li> </ul>	8	CO1
2	PROCEDURE OF GIT, SALIVARY GLAND AND BILIARY SYSTEM	<ul> <li>Gastrointestinal Tract: Barium Swallow, Barium Meal and Follow Through, Hypotonic Duodenography, Small Bowel Enema, Barium Enema, Double Contrast studies; Colostomy. Special techniques for specific disease to be examined. Including water soluble contrast media - eg. Gastrograffin Studies. Including CT, US and MRI Special Imaging Techniques.</li> <li>Biliary system: Intravenous cholangiography (IVC), Percutaneous cholangiography (PTHC), Endoscopic retrograde cholangio- pancreatography (ERCP), Operative Cholangiography, Post-Operative cholangiography (T-tube Cholangiography), Including CT, US and MRI Special Imaging Techniques.</li> </ul>	8	CO2
3	PROCEDURE OF URINARY SYSTEM, BREAST & SALIVARY GLANDS	<ul> <li>Urinary system: IVU, Retrograde Pyelography, Antegrade Pyelography, Cystography and MCU, Urethrography (RGU), Including CT, US and MRI Special Imaging Techniques.</li> <li>Salivary glands: Routine technique, procedure - sialography.</li> <li>Breast Imaging: Mammography: Basic views, special views, wire localization.</li> </ul>	8	CO3
4	PROCEDURE OF REPRODUCTIVE & RESPIRATORY SYSTEM & DCG	<ul> <li><b>Reproductive system:</b> All the Techniques relating to Male and Female reproductive system including Hysterosalpingography.</li> <li><b>Respiratory system:</b> - Bronchography: Including CT, US and MRI Special Imaging Techniques.</li> <li><b>Dacryocystography</b></li> </ul>	8	CO4
5	SINOGRAPHY, CNS PROCEDURE & ARTHROGRAPHY	<ul> <li>Sinography: Routine technique and procedure.</li> <li>Central Nervous System: Myelography, Cerebral studies, Ventriculography etc including CT, US and MRI Special Imaging Techniques.</li> <li>Arthrography: Shoulder, Hip, Knee, Elbow joints etc including CT, US and MRI Special Imaging Techniques.</li> </ul>	8	CO5
Referen	nce Books:			
	· · ·	C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.		
A 75 1		ecial Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.		
		adiological differential diagnosis. Elsevier Health Sciences; 2013 Nov 20. aphic Technique & Darkroom Practice		
		C.K.J. (2009) Textbook of Microbiology. 8thedition, University Press Publication.		
e-Lea	rning Source:			
1.	https://youtu.be/IYfL-V2C			
2.	https://youtu.be/zYl2G2Z			
3.	https://www.britannica.com	m/technology/microscope		

		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	10/	100	10)	1010	1011	1012	1501	1502	1505	1304
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			Att	ributes				SDGs	
RS509	Radiological and	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.	
	Imaging Procedures	$\checkmark$	$\checkmark$	$\checkmark$	V		$\checkmark$	$\checkmark$	3,4	



	integral Oniversity, Edeknow									
Effective	e from Session	n: 2023-24								
Course	Code	RS510	Title of the Course	Residency – II Lab	L	Т	Р	С		
Year		Ι	Semester	П	0	0	10	5		
Pre-Req	quisite Nil Nil									
Course	<b>Objectives</b> The objective of the Residency Lab is to learn about patient handling, radiation protection and procedures done in the department.									
		Course Outcomes	After the successful co	ourse completion, learners will develop following attributes:						
CO1	Students wil	l be able to learn how	to deal with a patient du	ring examination in the Radiology department.						
CO2	Students wil	l be able to learn how	to perform X-Ray Exam	inations.						
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 No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO			
1	Course Contents						
Refer	ence Books:						
1	Seeram E. Computed Tomograp	phy-E-Book: Physical Principles, Clinical.					
2. A	Applications and Quality Control	ol. Elsevier Health Sciences; 2015 Sep 2.					
3. L	akhkar B N, Banavali S, Shetty	y C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.					
4. S	nopek AM. Fundamentals of S	pecial Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.					
5. 0	Curry TS, Dowdey JE, Murry RO	C. Christensen's physics of diagnostic cardiology. Lippincott Williams & Wilkins; 1990.					
6. E	Brant WE, Helms CA, editors. F	undamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.					
7. Z	Zwiebel WJ, Sohaey R. Introduc	ction to ultrasound. WB Saunders Company;1998.					
8. F	lagen-Ansert SL. Textbook of c	liagnostic ultrasonography. Mosby Elsevier;2006.					
e-Le	earning Source:						
1. <u>h</u>	ttps://en.wikipedia.org/wiki/Hig	h-resolution_computed_tomography					
	ttps://youtu.be/IhjbvEnlRrM						
3. <u>h</u>	ttps://en.wikipedia.org/wiki/Dop	ppler_ultrasonography_					

		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	101	105	100	10/	100	10)	1010	1011	1012	1501	1502	1505	1501
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

Course Code	Course Title		Attributes								
RS510	Residency – II Lab	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.		
	2	$\checkmark$	$\checkmark$	V	$\checkmark$		$\checkmark$	$\checkmark$	3,4		



Effective from Sessi	Affective from Session: 2023-24											
Course Code	RS511	Title of the Course	Modern Radiological and Imaging Equipment –Lab	L	Т	P	C					
Year	Ι	Semester	Ш	0	0	8	4					
Pre-Requisite	Nil	Co-requisite Nil										
Course Objectives		rpose of this course is to provide an understanding of practical concepts and underlying various or provide an understanding of practical applications of advance modalities of radiology department.										
•	teennologi	ological 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 No.	Tit	le of th	e Unit						C	content o	f Unit					Contact Hrs.	Mapped CO
1		LIST ACT			<ol> <li>Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of topographic movements,</li> <li>Tomosynthesis, Stitch radiography</li> <li>DEXA scan.</li> <li>Vascular Imaging Equipment: Introduction, historical developments DSA Equipment</li> <li>Computed Tomography</li> <li>Ultrasonography</li> <li>Ultrasonography</li> <li>Transducers of USG</li> <li>MRI</li> <li>Contrast Agents in MRI, Image quality, Image artifacts and its compensators, NMR hazard and safety. Advances in MRI.</li> <li>MR Spectroscopy</li> <li>Radionuclide scanning including rectilinear scanner, gamma camera, PET, SPECT, their principles, working, applications and advancements.</li> </ol>										its nera,	80	CO1, CO2, CO3, CO4, CO5
Refere	nce Boo	ks:				111,	JI LC I	, then	princip	103, WOI	king, up	pileution	is and a		ents.		
	e physics																
									0	stic radio	logy.						
	ker AK, N	-						-		-aw-Hill H	lealth Pro	fessions	Division; 1	997			
									Compar		leannin		, in 1910, i	557			
e-Lea	rning So	urce:	-														
	tps://ww						201731	9									
-	tps://ww tps://en.v			-			graphy										
								ticulati	on Mati	ix: (Mar	ning of (	Os with	POs and	PSOs)			
PO-F	PSO	DC1	DCC	DCC	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										DECO	DCCC	DCC
CO	0	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CC		3	3	3	3	2	2	3	3	3	3	3	2	2	2	3	3
CC		2	3	23	$\frac{2}{2}$	3	3	3	3	2	3	3	2	2	3	3	3
		$\frac{3}{2}$	2	3 2	2	3	2	2	3	$\frac{2}{3}$	$\frac{2}{2}$	3	3	2	3	3	3
		2	3	3	3												

Course Code	Course Title	Attributes								
RS511	Modern Radiological and Imaging Equipment	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.	
ROUT	–Lab			$\checkmark$					3,4, 11	



Effective from Session	: 2023-24										
Course Code	RS512	Title of the Course	Radiological and Imaging Procedures – Lab	L	Т	Р	С				
Year	I	Semester	Ш	0	0	8	4				
Pre-Requisite	NIL	Co-requisite	Nil								
Course Objectives	The objective is to	ective is to learn contrast-imaging techniques under the guidance of fluoroscopy, the administration of 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	<ol> <li>Contrast Media</li> <li>Emergency Drugs in the Radiology Department</li> <li>Gastrointestinal Tract</li> <li>Salivary glands: Routine technique, procedure - sialography</li> <li>Biliary system: (ERCP). Operative cholangiography, post-Operative cholangiography (T-tube Cholangiography).</li> <li>Urinary system</li> <li>Reproductive system</li> <li>Breast Imaging</li> <li>Respiratory system</li> <li>Sinography: Routine technique and procedure.</li> <li>Central Nervous System</li> <li>Angiographic Studies</li> <li>Venography</li> </ol>	80	CO1, CO2, CO3, CO4, CO5
	ce Books:			
		hetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.		
^		of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13. s to radiological differential diagnosis. ElsevierHealth Sciences; 2013 Nov 20.		
	-	liographic Technique & Darkroom Practice		
		niker C.K.J. (2009) Textbook of Microbiology. 8thedition, University Press Publication.		
	ning Source:			
	s://youtu.be/lYfL-V2C9Uw	2		
	s://youtu.be/zYl2G2Z_T7N			
3. <u>http</u>	os://www.britannica.com	/technology/microscope		

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
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								
RS512	Radiological and Imaging Procedures –	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	No.	
	Lab	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	3,4	