



**INTEGRAL UNIVERSITY,
LUCKNOW**

**INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES &
RESEARCH**

DEPARTMENT OF PARAMEDICAL SCIENCES

**BACHELOR OF SCIENCE IN RADIOLOGICAL
IMAGING TECHNOLOGY
(B.Sc. RIT)**

SYLLABUS

YEAR/ SEMESTER: II/III



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

Program: B.Sc. RIT

Semester-III

S. N.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credits
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1	RT201	Radiographic Positioning- Part II	Core	2	1	0	40	20	60	40	100	2:1:0	3
2	RT202	Conventional Radiographic Techniques-Part I	Core	2	1	0	40	20	60	40	100	2:1:0	3
3	RT203	Radiation Protection and Quality assurance	Core	2	1	0	40	20	60	40	100	2:1:0	3
4	RT204	Fundamental of Microbiology -I	Core	2	1	0	40	20	60	40	100	2:1:0	3
5	RT205	Immunology & Serology -I	Core	2	1	0	40	20	60	40	100	2:1:0	3
6	ES101	Environmental Studies	Core	2	1	0	40	20	60	40	100	2:1:0	3
PRACTICAL													
1	RT206	Radiographic Positioning- Part II Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
2	RT207	Conventional Radiographic Techniques- Part I -Lab	Core	0	0	4	40	20	60	40	100	0:0:2	2
3	RT208	Radiation Protection and Quality Assurance-Lab	Core	0	0	4	40	20	60	40	100	0:0:2	2
4	RT209	Fundamentals of Microbiology & Immunology-I Lab	Core	0	0	4	40	20	60	40	100	0:0:2	2
Total				12	06	14	400	200	600	400	1000	25	25

S. N.	Course code	Course Title	Type of Paper	Attributes						United Nation Sustainable Development Goal (SDGs)	
				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value		Professional Ethics
THEORIES											
1	RT201	Radiographic Positioning- Part II	Core	√	√	√			√	√	3,4
2	RT202	Conventional Radiographic Techniques-Part I	Core	√	√	√	√		√	√	3,4
3	RT203	Radiation Protection and Quality assurance	Core	√	√	√	√		√	√	3,4
4	RT204	Fundamental of Microbiology -I	Core	√	√	√	√		√	√	3,4
5	RT205	Immunology & Serology -I	Core	√	√	√	√		√	√	3,4
6	ES101	Environmental Studies	Core					√			3,4,11,16
PRACTICAL											
1	RT206	Radiographic Positioning- Part II Lab	Core	√	√	√	√		√	√	3,4
2	RT207	Conventional Radiographic Techniques- Part I -Lab	Core	√	√	√	√		√	√	3,4
3	RT208	Radiation Protection and Quality Assurance-Lab	Core	√	√	√	√		√	√	3,4
4	RT209	Fundamentals of Microbiology & Immunology-I Lab	Core	√	√	√	√		√	√	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)



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT201	Title of the Course	RADIOGRAPHIC POSITIONING- PART II	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to learn basic and special projections for the better delineation diagnosis of the disease conditions of different anatomical structures (Upper and Lower Extremities, Shoulder Joint, Pelvis Griddle, Whole Spine).						

Course Outcomes	
CO1	Students will be able to learn about Basic and special projection- Related radiological anatomy a. Finger-PA, LAT, OBLIQUE- Hand-PA, LAT- Wrist joint-PA, LAT -Forearm-AP.
CO2	Students will be able to learn Basic and special projections-Related radiological anatomy, Shoulder-AP, and AXIAL b. Clavicle-AP, AP AXIAL c. Scapula-AP, OBLIQUE, Y VIEW.
CO3	Students will be able to learn Pelvic girdle: AP pelvis, Frog lateral (modified cleaves method), and AP axial for pelvic outlet.
CO4	Students will be able to learn Cervical spine Related radiological anatomy, Basic views, and AP open mouth (C1 and C2).
CO5	Students will be able to learn Positioning, care and radiation protection while handling babies.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	UPPER & LOWER EXTREMITIES	a. Basic and special projection- Related radiological anatomy. b. Finger-PA, LAT, OBLIQUE- Hand-PA, LAT- Wrist joint-PA, LAT -Forearm-AP, LAT. c. Elbow joint-AP, LAT- Humerus-AP, LA. d. Femur-AP, LAT- Knee joint- AP, LAT- Patella-SKYLINE VIEW-Tibia-AP, LAT-Ankle joint- AP, LAT, MORTIS VIEW- Foot –AP, LAT.	6	CO1
2	SHOULDER JOINTS	Basic and special projections- Related radiological anatomy. a. Shoulder-AP, AXIAL b. Clavicle -AP, AP AXIAL c. Scapula-AP, OBLIQUE, Y VIEW	6	CO2
3	PELVIC GIRDLE AND PROXIMAL FEMUR	Basic & special projections- Related radiological anatomy a. Pelvic girdle: AP pelvis, Frog lateral (modified cleaves method), AP axial for pelvic outlet (tayelor method), AP axial for pelvic inlet (modified linienfield method), Posterior oblique-acetabulum (judet method) b. Hip and proximal femur: AP unilateral hip, Axio-lateral, infero-superior (danelius – miller method), Unilateral frog leg (modified cleaves method), Modified axiolateral (Clements-Nakayama method) c. Sacrio-iliac joints: AP, posterior oblique’s	6	CO3
4	WHOLE SPINE POSITIONING	1. Cervical spine: Related radiological anatomy a. Basic views, AP open mouth (C1 and C2), AP axial, Oblique, Lateral, Erect, Trauma lateral (horizontal beam), Cervicothoracic junction (swimmers view) b. Special views: Lateral- hyperflexion and hyperextension AP (Fuchs method) or PA (Judd method), AP wagging jaw (ottonello method), AP axial (pillars). 2. Thoracic spine: Related radiographic anatomy: Projections, AP, Lateral, and Oblique. Lumbar spine, sacrum and coccyx: Related radiographic anatomy a Lumbar spine: AP, Oblique, Lateral, Lateral (L5 – S1), AP axial (L5 –S1). b Scoliosis series: AP or PA, Erect, lateral, AP (Ferguson method), AP–Rand L bending. c Spinal fusion series: AP or PA – R and L bending, Lateral –hyperextension and hyper flexion. Sacrum and Coccyx: AP axial sacrum, AP axial coccyx, Lateral sacrum, Lateral coccyx.	6	CO4
5	PAEDIATRIC RADIOGRAPHY	Positioning, care and radiation protection while handling babies.	6	CO5

Reference Books:

- Whitley AS, Jefferson G, Holmes K, Sloane C, Anderson C, Hoadley G. Clark's Positioning in Radiography 13E. CRC Press; 2015 Jul28.
- Bontrager KL, Lampignano J. Textbook of Radiographic Positioning and Related Anatomy-E-Book. Elsevier Health Sciences; 2013 Aug7.
- Bontrager KL, Lampignano J. Bontrager's Handbook of Radiographic Positioning and Techniques-E-BOOK. Elsevier Health Sciences; 2017
- FrankED, LongBW, SmithBJ.Merrill'sAtlasofRadiographicPositioningandProcedures-E-Book. Elsevier Health Sciences; 2013 Aug13.

e-Learning Source:

- <https://www.slideshare.net/InfoUtilRT/upper-extremity-anatomy-positioning>
- <https://youtu.be/LJStHhk5e9w>

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	3	3	3	3	3	3	2	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CO3	3	2	3	3	3	2	3	2	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	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

Course Code	Course Title	Attributes							SDGs No.	
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics		
RT201	RADIOGRAPHIC POSITIONING- PART II	√	√	√				√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT202	Title of the Course	CONVENTIONAL RADIOGRAPHIC TECHNIQUES- PART I	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The main objective is to aware the student about conventional technique of radio imaging technique like (manual image processing & fluoroscopy / dynamic imaging) along with image formation, developing and reading.						

Course Outcomes	
CO1	Students will be able to learn about Radiation, Sources of radiation, Radioactivity, Half-life, Ionizing & Non-ionizing Radiation, and History of x-ray production.
CO2	Students will be able to learn about Characteristic Radiation, Bremsstrahlung Radiation, X-ray Emission Spectrum, and the Properties of X-ray.
CO3	Students will be able to learn about X-ray film construction, Emulsion, Formation of the latent image, Types of film.
CO4	Students will be able to learn about understanding the Handling and storage of film.
CO5	Students will be able to understand the Development of modern Radiology X-Ray Tube- External components- X-ray tube support.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION TO RADIOLOGIC IMAGING	Radiation, Sources of radiation, Radioactivity, Half-life, Ionizing & Non-ionizing Radiation, History of x-ray production, Development of modern Radiology X-Ray Tube- External components- X-ray tube support, Protective housing, Glass or metal Enclosure, Internal components- cathode, anode, focusing cup, focal spot, Line focus principle, Heel effect, X-ray tube failure, Rating charts.	6	CO1
2	X-RAY PRODUCTION	Characteristic Radiation Bremsstrahlung Radiation, X-ray Emission Spectrum, Properties of X-ray, X-ray quality, X-ray quantity, Half value layer. Interaction of x-ray with matter- Coherent scattering, Compton effect, Photoelectric effect, Pair Production, Photodisintegration, Differential absorption.	6	CO2
3	THE RECORDING SYSTEM	X-ray film construction, Emulsion, Formation of latent image, Types of film, Handling and storage of film, Construction of Intensifying screen, Luminescence, screen characteristics, Cassette construction and types, silver recovery, Film artifacts.	6	CO3
4	PROCESSING OF LATENT IMAGE	Manual Processing, Automatic processing, Processing sequence, wetting, developing, fixing, washing, Drying, Processing area (Darkroom) Characteristic curve, Optical density, Geometry of Radiographic image- magnification, distortion, focal spot blur, Subject factors.	6	CO4
5	FLUOROSCOPY	Introduction to fluoroscopy, Techniques of fluoroscopy, Image Intensifier, Flux gain, Brightness gain, Minification gain, Multifield image intensifier, Cathode ray tube.	6	CO5

Reference Books:	
1. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.	
2. Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.	
3. Adam A, Dixon AK, Gillard JH, Schaefer-Prokop C, Grainger RG, Allison DJ. Grainger & Allison's Diagnostic Radiology E-Book. Elsevier Health Sciences.	
4. D N and M O Chesney- X ray equipments for student radiographers- Third edition.	
5. Burgener FA, Korman M. Differential diagnosis in conventional radiology.	
6. The physics of radiology and imaging by K Thayalan.	
e-Learning Source:	
1. https://youtu.be/SHvA15yIyS0	
2. https://www.slideshare.net/anurajgowda/dark-room-procedures-72201093	
3. https://en.wikipedia.org/wiki/Fluoroscopy	

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	1	3	1	2	2	1	3	1	2	2	2	2	2	3	2	3
CO2	1	3	1	3	2	2	2	1	3	3	3	3	3	2	2	1
CO3	1	3	1	2	3	2	3	1	2	1	2	2	3	3	3	2
CO4	1	3	1	2	2	3	2	1	3	2	1	3	2	3	3	3
CO5	1	3	1	2	2	2	2	1	2	2	2	2	2	3	2	3

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

Attributes & SDGs

Course Code	Course Title	Attributes						SDGs No.	
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT202	CONVENTIONAL RADIOGRAPHIC TECHNIQUES- PART I	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT203	Title of the Course	RADIATION PROTECTION AND QUALITY	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to learn the aim, objective, philosophy and principle of radiation protection to protect oneself from the biological effects of radiation and monitoring radiation exposure.						

Course Outcomes: After the successful course completion, learners will develop following attributes:	
CO1	Student will have knowledge on Radiobiology and its energy determinants and Radiation Protection in Radiography.
CO2	Student will have knowledge on Personnel – Film badge, TLD, OSLD, pocket dosimeter, Area monitoring Devices.
CO3	Student will have knowledge on Quality control and assessment of equipment installed in radio department.
CO4	Student will have knowledge about care and maintenance of equipments in radiology department.
CO5	Student will have knowledge on Layout planning of radiology department according to ICRP, AERB recommendation.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION TO RADIATION PROTECTION, UNITS & QUANTITIES	a. Introduction to Radiation Protection, Units & Quantities- Primary, secondary radiation, need for radiation protection, Exposure, absorbed dose, absorbed dose equivalent, Effective dose, air KERMA, Radiation weighting factor, Tissue weighting factor, MPD. Aim & Principle of Radiation Protection- Concept of ALARA, Cardinal Principle, ICR Regulation, Radiation Protection in: Radiography, CT, Fluoroscopy, Mammography, Ward radiography, radiation shielding.	6	CO1
2	RADIATION MONITORING	a. Radiation monitoring: Personnel – Film badge, TLD, OSLD, pocket dosimeter, Area Monitoring Devices. Radiobiology: Radiolysis of water, Direct & Indirect effects of radiation, Stochastic, Deterministic effects, Somatic, Genetic effects, dose relationship, Antenatal exposure. 10-day rule, 14-day rule, 28-day rule, structural shielding, workload, use factor, occupancy factor.	6	CO2
3	QUALITY CONTROL AND ASSESSMENT IN RADIOLOGY	Quality Control and Assessment in Radiology: Quality Assurance and quality control of Modern Radiological and Imaging Equipment, which includes Digital Radiography, Computed Radiography, CT scan, MRI Scan, Ultrasonography and Tele radiology and PAC, related.	6	CO3
4	ROLE OF RADIOGRAPHER IN PLANNING, QA & RADIATION PROTECTION	Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.	6	CO4
5	ROLE OF RADIOGRAPHER IN PLANNING, QA & RADIATION PROTECTION	Role of Radiographer in Planning, QA & Radiation Protection: Role of technologist in radiology department - Personnel and area monitoring. ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDDT Act and guidelines.	6	CO5

Reference Books:	
1.	Sherer MA, Visconti PJ, Ritenour ER, Haynes K. Radiation Protection in Medical Radiography-E-Book. Elsevier Health Sciences; 2014Mar12.
2.	Brandon AN, Hill DR. Selected list of books and journals in allied health. Bulletin of the Medical Library Association, 1996.
3.	Long BW, Frank ED, Ehrlich RA. Radiography Essentials for Limited Practice-E-Book. Elsevier Health Sciences; 2016 Sep6
4.	Durrani SA, Ilic R, editors. Radon measurements by etched track detectors: applications in radiation protection, earth sciences and the environment. World scientific
5.	Turner JE. Atoms, radiation, and radiation protection. John Wiley & Sons; 2008Jan8
6.	Radiation protection in medical radiography by Mary Alice, Paula J Visconti et.al.
e-Learning Source:	
1.	https://en.wikipedia.org/wiki/Radiation_protection
2.	https://youtu.be/mvjYRGjrKHc
3.	https://www.slideshare.net/RubiSapkota/radiation-protection-and-personnel-monitoring-devices

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	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	2	3	3	3	2	3	2	3	2	2	2	3	2	3	2	3

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

Course Code	Course Title	Attributes							SDGs No.
RT203	RADIATION PROTECTION AND QUALITY	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	3,4
		√	√	√	√		√	√	



Integral University, Lucknow

Effective from Session: 2018-19										
Course Code	ES101	Title of the Course	ENVIRONMENTAL STUDIES				L	T	P	C
Year	II	Semester	III				2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil							
Course Objectives	The student will have awareness of our environment in general, natural resources, ecosystems, environmental pollution and social issues related to environment.									

Course Outcomes	
CO1	To study about the Environment and the ECO system.
CO2	To study about the Natural Resources.
CO3	To study about Biodiversity and Conservation
CO4	To study Environmental pollution, its policies and practices
CO5	To study Human Population and Environmental Ethics.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION TO ENVIRONMENT AND ECOSYSTEMS	Environment, its components and segments, Multidisciplinary nature of Environmental studies, Concept of Sustainability and sustainable development, Environmental movements, Ecosystem, Structure & Function, Energy flow in the Ecosystem, Ecological Pyramids and Ecological Succession.	6	CO1
2	NATURAL RESOURCES	Energy Resources: Renewable and non-renewable, Soil erosion and desertification, Deforestation, Water: Use and over exploitation, Impacts of large Dams, Case studies.	6	CO2
3	BIODIVERSITY AND CONSERVATION	Levels of biological diversity, Hot spots of biodiversity, India as a Mega Diversity Nation, Endangered and endemic species of India, Threats to Biodiversity, Conservation of Biodiversity, Ecosystem and biodiversity services.	6	CO3
4	ENVIRONMENTAL POLLUTION, POLICIES AND PRACTICES	a. Environmental pollution, Solid waste management, Ill effects of fireworks, Climate change, Ozone layer depletion, acid rain and impacts on human communities and Environment. Environmental Laws: Environment Protection Act, Wildlife protection Act, Forest conservation Act, Convention on Biological Diversity (CBD), Tribal rights, Human wildlife conflicts.	6	CO4
5	HUMAN POPULATION AND THE ENVIRONMENT	Human population growth: Impacts on environment, human health and welfare, Resettlement and rehabilitation of project-affected persons, Environmental ethics, Environmental communication and public awareness, case studies.	6	CO5

Reference Books:																
1. Agarwal, K.C. 2001 Environmental; Biology, Nidi Pub. Ltd. Bikaner.																
2. Bharucha Erach, The Biodiversity of India, Mapin Pub. Pvt. Ltd., Ahemdabad-380, India.																
3. Brunner R.C. 1989. Hazardous waste incineration, Mc Graw Hill.																
4. Clark R.S. Marine Pollution, Clanderon Press Oxford (TB).																
5. Cunningham W.P.2001.Cooper, T.H. Gorhani, E & Hepworth, Environmental encyclopedia, Jaicob Publication House,Mumbai																
6. De. A.K. Environmental chemistry Willey Eastern Limited.																
7. Glick, H.P.1993 water in crisis, Pacific Institute for studies in dev, Environment & security, Stockholm Env, Institute, Oxford Univ, Press 473p.																
8. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society,Bombay																
e-Learning Source:																
1. https://www.vedantu.com/biology/difference-between-environment-and-ecosystem																
2. https://en.wikipedia.org/wiki/Natural_resource																
3. https://en.wikipedia.org/wiki/Biodiversity																

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	3	2
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	2	3	3	3	2	3	2	2	3	2	3	2	3	2	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.	
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics		
ES101	ENVIRONMENTAL STUDIES							√		3,4, 11



Integral University, Lucknow

Effective from Session: 2018-19

Course Code	RT205	Title of the Course	IMMUNOLOGY & SEROLOGY - I	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases						

Course Outcomes

CO1	Student will have knowledge about Immune system.
CO2	Student will have knowledge about antigen and antibodies.
CO3	Student will have knowledge about mechanism of humoral and complement system.
CO4	Student will have knowledge about tests done for antigen and antibody detection.
CO5	Student will have knowledge about rheumatological diseases.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION TO THE IMMUNE SYSTEM AND IMMUNITY	a. Historical background, general concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response. b. Cell and organs of the immune system, Phagocytosis	6	CO1
2	ANTIGEN & ANTIBODIES	a. Antigens and haptens: Properties, foreignness, molecular size, heterogeneity, B and T cell epitopes; T dependent and T independent antigens. b. Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies; different classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype. c. Introduction of hybridoma technology, monoclonal antibodies, and polyclonal antibody.	6	CO2
3	MECHANISM OF HUMORAL AND COMPLEMENT SYSTEM	a. Mechanism of humoral and cell-mediated immune response b. Introduction of Major Histocompatibility Complex, organization of MHC and inheritance in humans; Antigen presenting cells, antigen processing and presentation. c. Complement system and complement fixation test.	6	CO3
4	ANTIGEN & ANTIBODY TEST	Laboratory tests for demonstration of antigen antibody reaction such as agglutination, Precipitation, ELISA, RIA, Immune of fluorescence.	6	CO4
5	RHEUMATOLOGICAL DISEASE	Rheumatologically diseases, etiologic and pathogenesis and lab investigations.	6	CO5

Reference Books:

1. Abbas A K, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh
3. Richard C and Geffrey S. (2009). Immunology, 6th edition, Wiley Blackwell Publication.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York
5. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley- Blackwell Scientific Publication, Oxford
6. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York

e-Learning Source:

1. https://en.wikipedia.org/wiki/Immune_system
2. https://youtu.be/GzuM_nfrXLk
3. <https://youtu.be/RYYV1R8ywXM>
4. <https://www.mayoclinichealthsystem.org/locations/mankato/services-and-treatments/rheumatology/rheumatic-diseases>

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	3	2	2	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	2	3	3	3	2	3	2	3	2	2	2	3	2	3	2	3

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

Course Code	Course Title	Attributes						SDGs No.	
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value		Professional Ethics
LT205	IMMUNOLOGY & SEROLOGY - I			√					3,4, 11



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT206	Title of the Course	RADIOGRAPHIC POSITIONING- PART II LAB	L	T	P	C
Year	II	Semester	III	0	0	4	2
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to learn basic and special projections for the better delineation diagnosis of the disease conditions of different anatomical structures (Upper and Lower Extremities, Shoulder Joint, Pelvis Griddle, Whole Spine).						

Course Outcomes	
CO1	Students will be able to learn about Basic and special projection- Related radiological anatomy a. Finger-PA, LAT, OBLIQUE- Hand-PA, LAT- Wrist joint-PA, LAT -Forearm-AP.
CO2	Students will be able to learn Basic and special projections-Related radiological anatomy, Shoulder-AP, and AXIAL b. Clavicle-AP, AP AXIAL c. Scapula-AP, OBLIQUE, Y VIEW.
CO3	Students will be able to learn Pelvic girdle: AP pelvis, Frog lateral (modified cleaves method), and AP axial for pelvic outlet.
CO4	Students will be able to learn Cervical spine Related radiological anatomy, Basic views, and AP open mouth (C1 and C2).
CO5	Students will be able to learn Positioning, care and radiation protection while handling babies.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	PROJECTIONS OF EXTREMITIES	1. Upper & Lower Extremities, Hand & Foot.	3	CO1
2	ARM AND LEG VIEWS	2. Forearm Arm, Thigh, Leg, and Foot	3	CO1
3	SHOULDER VIEWS	3. Shoulder Joints.	3	CO2
4	SHOULDER SPECIAL VIEWS	4. Basic & special projection Related radiological Pathology Basic & special positioning.	4	CO2
5	PELVIS VIEWS	5. Pelvis Griddle.	4	CO3
6	PELVIS SPECIAL VIEWS	6. Basic & special projection Related radiological Pathology Basic & special positioning.	4	CO3
7	SPINE VIEW	7. Whole Spine Positioning.	3	CO4
8	CERVICAL & THORACIC VIEWS	8. Cervical spine Thoracic spine	4	CO4
9	LOWER SPINE VIEWS	9. Lumbar spine, sacrum and coccyx.	4	CO4
10	PEDIATRIC RADIOGRAPHY	10. Pediatric Radiography.	4	CO5
11	SPECIAL VIEWS	11. Special Positioning Views for all the X-Rays.	4	CO5

Reference Books:

- 1 Whitley AS, Jefferson G, Holmes K, Sloane C, Anderson C, Hoadley G. Clark's Positioning in Radiography 13E. CRC Press; 2015 Jul 28.
- 2 Bontrager KL, Lampignano J. Textbook of Radiographic Positioning and Related Anatomy-E-Book. Elsevier Health Sciences; 2013 Aug 7.
- 3 Bontrager KL, Lampignano J. Bontrager's Handbook of Radiographic Positioning and Techniques-E-BOOK. Elsevier Health Sciences; 2017 Feb 10.
- 4 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. <https://www.slideshare.net/InfoUtilRT/upper-extremity-anatomy-positioning>
2. <https://youtu.be/LIStHhk5e9w>
3. <https://youtu.be/C2Ud4EwZVQM>

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	3	2
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	2	3	3	3	2	3	2	2	3	2	3	2	3	2	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3

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

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT206	RADIOGRAPHIC POSITIONING- PART II LAB	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT207	Title of the Course	CONVENTIONAL RADIOGRAPHIC TECHNIQUES-ILAB	L	T	P	C
Year	II	Semester	III	0	0	4	2
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The main objective is to aware the student about conventional technique of radio imaging technique like (manual image processing & fluoroscopy / dynamic imaging) along with image formation, developing and reading. Students must know about its practical aspects and handling procedures.						

Course Outcomes	
CO1	Students will be able to learn about Radiation, Sources of radiation, Radioactivity, Half-life, Ionizing & Non-ionizing Radiation, and History of x-ray production.
CO2	Students will be able to learn about Characteristic Radiation, Bremsstrahlung Radiation, X-ray Emission Spectrum, and the the Properties of X-ray.
CO3	Students will be able to learn about X-ray film construction, Emulsion, Formation of the latent image, Types of film.
CO4	Students will be able to learn about understanding the Handling and storage of film.
CO5	Students will be able to understand the Development of modern Radiology X-Ray Tube- External components- X-ray tube support.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION TO RADIOLOGIC IMAGING	1. Introduction to Radiologic Imaging.	10	CO1
2	X-RAY PRODUCTION	2. X-Ray Production.	10	CO2
3	THE RECORDING SYSTEM	3. The Recording System.	10	CO3
4	PROCESSING OF LATENT IMAGE	4. Processing of Latent Image techniques.	05	CO4
5	FLUOROSCOPY	5. Handling of Fluoroscopy.	05	CO5

Reference Books:

1. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar 20.
2. Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.
3. Adam A, Dixon AK, Gillard JH, Schaefer-Prokop C, Grainger RG, Allison DJ. Grainger & Allison's Diagnostic Radiology E-Book. Elsevier Health Sciences.
4. D N and M O Chesney- X ray equipments for student radiographers- Third edition.
5. Burgener FA, Korman M. Differential diagnosis in conventional radiology.

e-Learning Source:

1. <https://youtu.be/SHvAl5yIyS0>
2. <https://www.slideshare.net/anurajgowda/dark-room-procedures-72201093>
3. <https://en.wikipedia.org/wiki/Fluoroscopy>

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	CO1	1	3	1	2	3	2	1	1	2	3	1	2	2	3	2
CO2	1	3	1	3	3	3	3	1	3	3	3	3	3	3	3	2
CO3	1	3	1	2	1	2	1	1	2	2	1	2	3	1	2	3
CO4	1	3	1	2	2	2	2	1	3	3	2	3	2	2	2	1
CO5	1	3	1	2	1	2	2	1	2	2	2	2	2	1	2	3

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT207	CONVENTIONAL RADIOGRAPHIC TECHNIQUES-ILAB	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT208	Title of the Course	RADIATION PROTECTION AND QUALITY ASSURANCE-LAB	L	T	P	C
Year	II	Semester	III	0	0	4	2
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to learn the aim, objective, philosophy and principle of radiation protection to protect oneself from the biological effects of radiation and monitoring radiation exposure.						

Course Outcomes	
CO1	Student will have knowledge on Radiation Protection in Radiography.
CO2	Student will have knowledge on principle of Radiation Protection.
CO3	Student will have knowledge on Radiation Monitoring.
CO4	Student will have knowledge about care and maintenance in radiology.
CO5	Student will have knowledge about QA & QC in Radiology.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION TO RADIATION PROTECTION, UNITS & QUANTITIES	1. Introduction to Radiation Protection, Units & Quantities.	7	CO1
2	PRINCIPLE OF RADIATION PROTECTION	2. Aim & Principle of Radiation Protection.	7	CO2
3	RADIATION MONITORING	3. Radiation monitoring.	7	CO3
4	ROLE OF RADIOGRAPHER IN QC & QA	4. Quality Control and Assessment in Radiology.	7	CO4
5	ROLE OF RADIOGRAPHER IN CARE AND MAINTENANCE	5. Care and maintenance of diagnostic equipment.	6	CO5
6	ROLE OF RADIOGRAPHER IN PLANNING	6. Role of Radiographer in Planning, QA & Radiation Protection.	6	CO5

Reference Books:

1. Brandon AN, Hill DR. Selected list of books and journals in allied health. Bulletin of the Medical Library Association.1996
2. Sherer MA, Visconti PJ, Ritenour ER, Haynes K. Radiation Protection in Medical Radiography-E-Book. Elsevier Health Sciences; 2014 Mar12.
3. Long BW, Frank ED, Ehrlich RA. Radiography Essentials for Limited Practice-E-Book. Elsevier Health Sciences; 2016 Sep6
4. Durrani SA, Ilic R, editors. Radon measurements by etched track detectors: applications in radiation protection, earth sciences and the environment. Worldscientific.
5. Turner JE. Atoms, radiation, and radiation protection. John Wiley & Sons; 2008Jan8
6. www.AERB.com (Guidelines and Details of Quality Control in Radiology).

e-Learning Source:

1. https://en.wikipedia.org/wiki/Radiation_protection
2. <https://youtu.be/mvjYRGjrKHc>
3. <https://www.slideshare.net/RubiSapkota/radiation-protection-and-personnel-monitoring-devices>

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	3	2	2	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	2	3	3	3	2	3	2	3	2	2	2	3	2	3	2	3

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT208	RADIATION PROTECTION AND QUALITY ASSURANCE-LAB	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT209	Title of the Course	FUNDAMENTAL OF MICROBIOLOGY & IMMUNOLOGY-LAB	L	T	P	C
Year	II	Semester	III	0	0	4	2
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	This subject gives a general insight into the history, and basics of microbiology and imparts knowledge about the equipment used in microbiology and formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.						

Course Outcomes	
CO1	Student will be able to demonstrate microscope and glasswares.
CO2	Student will be able to demonstrate autoclave and hot air oven.
CO3	Student will be able to perform Gram staining, Acid fast staining & Indian ink staining.
CO4	Student will be able to demonstrate hanging drop method, capsule, bacterial spores and agglutination reactions.
CO5	Student will be able to perform RA, Widal, RPR & CRP test.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	MICROSCOPE PRACTICAL	1. Demonstration of Microscope and its parts.	3	CO1
2	GLASSWARE PRACTICAL	2. Demonstration of glassware used in microbiology.	3	CO1
3	AUTOCLAVE PRACTICAL	3. Demonstration of autoclave and sterilization of glass wares.	3	CO2
4	HOT AIR OVEN PRACTICAL	4. Demonstration of Hot air oven and sterilization of glass wares.	3	CO2
5	ACID FAST AND GRAM STAINING	5. To perform Gram staining & Acid-fast staining (Zeihl Neelsen staining)	3	CO3
6	INDIAN INK STAINING	6. To perform Indian ink staining	3	CO3
	HANGING DROP METHOD	7. To perform Hanging drop method.	3	CO4
7	CAPSULE DEMONSTRATION	8. Demonstration of capsule	3	CO4
	BACTERIAL SPORES STAINING	9. Staining of bacterial spores.	3	CO4
8	AGGLUTINATION REACTION	10. To demonstrate agglutination reaction.	3	CO4
9	RA TEST	11. To perform RA test.	4	CO5
10	WIDAL TEST	12. To perform Widal test.	4	CO5
11	RPR TEST	13. To perform RPR test.	4	CO5
12	CRP TEST	14. To perform CRP test.	4	CO5

Reference Books:

- Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley- Blackwell Scientific Publication, Oxford.
- Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
- Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
- Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
- Richard C and Geoffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

e-Learning Source:

- <https://youtu.be/vvFDypILkTA>
- <https://youtu.be/sxa46xKfIOY>
- <https://www.metropolisindia.com/blog/preventive-healthcare/widal-test-introduction-principle-procedure-preparation-price>

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	3	2	2	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	2	3	3	3	2	3	2	3	2	2	2	3	2	3	2	3

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT209	FUNDAMENTAL OF MICROBIOLOGY & IMMUNOLOGY-LAB	√	√	√	√				3,4



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

DEPARTMENT OF PARAMEDICAL SCIENCES

**BACHELOR OF SCIENCE IN RADIOLOGICAL
IMAGING TECHNOLOGY
(B.Sc. RIT)**

SYLLABUS

YEAR/ SEMESTER: II/IV



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

Program: B.Sc. RIT

Semester-IV

S. N.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credits
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1	RT210	Conventional Radiographic Techniques- Part II	Core	2	1	0	40	20	60	40	100	2:1:0	3
2	RT211	Special Radiographic Procedure	Core	2	1	0	40	20	60	40	100	2:1:0	3
3	RT212	Basics of USG and Mammography	Core	2	1	0	40	20	60	40	100	2:1:0	3
4	RT213	Basics of C T Scan	Core	2	1	0	40	20	60	40	100	2:1:0	3
5	RT214	Orientation in Par Clinical Sciences	Core	2	1	0	40	20	60	40	100	2:1:0	3
PRACTICAL													
1	RT215	Conventional Radiographic Techniques- Part II Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
2	RT216	Special Radiographic Procedure- Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
3	RT217	Basics of C T Scan-Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
4	RT218	Hospital Posting	Core	0	0	14	40	20	60	40	100	0:0:7	7
Total				10	05	20	360	180	540	360	900	25	25

S. N.	Course code	Course Title	Type of Paper	Attributes						United Nation Sustainable Development Goal (SDGs)	
				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value		Professional Ethics
THEORIES											
1	RT210	Conventional Radiographic Techniques- Part II	Core	√	√	√	√		√	√	3,4
2	RT211	Special Radiographic Procedure	Core	√	√	√	√		√	√	3,4
3	RT212	Basics of USG and Mammography	Core	√	√	√	√		√	√	3,4
4	RT213	Basics of C T Scan	Core	√	√	√	√		√	√	3,4
5	RT214	Orientation in Par Clinical Sciences	Core	√	√	√	√	√	√	√	3,4
PRACTICAL											
1	RT215	Conventional Radiographic Techniques- Part II Lab	Core	√	√	√	√		√	√	3,4
2	RT216	Special Radiographic Procedure- Lab	Core	√	√	√	√		√	√	3,4
3	RT217	Basics of C T Scan-Lab	Core	√	√	√	√		√	√	3,4
4	RT218	Hospital Posting	Core	√	√	√	√		√	√	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)



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT210	Title of the Course	CONVENTIONAL RADIOGRAPHIC TECHNIQUES- PART II	L	T	P	C
Year	II	Semester	IV	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The main objective is to aware the student about the conventional technique of radio imaging technique like (manual image processing & fluoroscopy / dynamic imaging) along with the image formation, developing and reading.						

Course Outcomes	
CO1	Students will be able to learn about portable, Mobile and C-Arm machines of radiology.
CO2	Students will be able to learn about fluoroscopy.
CO3	Students will be able to learn about X-ray and fluoroscopy tables.
CO4	Students will be able to learn about tomography equipment.
CO5	Students will be able to learn about cranial and dental radiography.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	PORTABLE & MOBILE EQUIPMENTS	1. Portable X-Ray Equipment Mains requirements. 2. Cable connections to wall plugs Mobile X-Ray Equipment 3. Ray Equipment for the Operating Theatre	6	CO1
2	FLUOROSCOPY EQUIPMENTS	1. Construction & Working principles of Image Intensifier. 2. Direct Fluoroscopy 3. Viewing the Intensified image. 4. Recording the intensified Image. 5. Digital fluoroscopy.	6	CO2
3	FLUOROSCOPIC / RADIOGRAPHIC TABLES	1. General features of fluoroscopic / radiographic table. 2. The serial changer 3. Remote control table. 4. The spot film devices.	6	CO3
4	TOMOGRAPHIC EQUIPMENT	1. Principles of tomography. 2. Various types of tomographic movement. 3. Equipment for tomography	6	CO4
5	EQUIPMENT FOR CRANIAL AND DENTAL RADIOGRAPHY	1. The skull table. 2. General Dental X-ray equipment 3. Pan tomography equipment. 4. Equipment for Cranial & skeletal radiography. 5. Direct and Indirect Radiography.	6	CO5

Reference Books:	
1.	Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins; 1990.
2.	Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.
3.	Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.
4.	Adam A, Dixon AK, Gillard JH, Schaefer-Prokop C, Grainger RG, Allison DJ. Grainger & Allison's Diagnostic Radiology E-Book. Elsevier Health Sciences.
5.	D N and M O Chesney- X ray equipments for student radiographers- Thirdedition
6.	Burgener FA, Korman M. Differential diagnosis in conventional radiology
e-Learning Source:	
1	https://youtu.be/R2-GB65Wa5w
2	https://youtu.be/JDYG-JEl6kI
3	https://youtu.be/IhjvEnlRrM

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	PSO
CO1	3	3	3	3	2	2	3	3	3	3	3	2	3	2	3	2	2
CO2	2	3	2	3	3	3	3	3	2	3	3	3	2	3	3	3	3
CO3	3	2	3	2	3	2	3	3	2	2	3	3	2	3	3	3	3
CO4	2	3	2	3	3	3	2	3	3	2	2	3	2	3	3	2	3
CO5	2	3	3	3	2	3	2	3	2	3	2	3	2	3	2	3	2

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

Course Code	Course Title	Attributes							SDGs No.
RT210	CONVENTIONAL RADIOGRAPHIC TECHNIQUES- PART II	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	3,4
		√	√	√	√		√	√	



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT211	Title of the Course	SPECIAL RADIOGRAPHIC PROCEDURE	L	T	P	C
Year	II	Semester	IV	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to learn contrast-imaging techniques under the guidance of fluoroscopy, the administration of contrast media and its safety aspect.						

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 and HSG.
CO4	Students will be able to learn about Nervous system and hepatobiliary procedures.
CO5	Students will be able to learn about Sialography, DCG, Sinogram, FNAC and Biopsy.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Radiographic Special Procedures	1. Contrast Media- Application, types, safety aspects & administration, Reaction to contrast media and management of contrast reactions.	6	CO1
2	Barium Procedures of GIT	1. Barium swallow, Barium meal 2. Barium meal follow-through (BMFT) 3. Barium enema	6	CO2
3	The procedure of the Urinary and Female Reproductive system	1. Intravenous pyelogram (IVU). 2. Micturating Cystourethrogram (MCU). 3. Ascending Urethrogram (ASU)/RGU. 4. Hysterosalpingography (HSG).	6	CO3
4	The procedure of the Nervous and Hepatobiliary system	1. Myelography 2. ERCP/ PTBD 3. PTC, T-tube cholangiography	6	CO4
5	Other Special Procedures	1. Sialography, 2. Dacrocystography, 3. Sinogram, 4. Fistulogram, 5. FNAC 6. Biopsy	6	CO5

Reference Books:	
1.	Lakhkar B N, Banavali S, Shetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.
2.	Snopek AM. Fundamentals of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.
3.	Davies SG, Chapman S. Aids to radiological differential diagnosis. Elsevier Health Sciences; 2013 Nov 20.
4.	Krishnamurthy, Medical Radiographic Technique & Darkroom Practice
e-Learning Source:	
1.	https://youtu.be/IYfL-V2C9Uw
2.	https://youtu.be/zYI2G2Z_T7M
3.	https://youtu.be/JQW9RilqUaw

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
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

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

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT211	SPECIAL RADIOGRAPHIC PROCEDURE	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19										
Course Code	RT212	Title of the Course	BASICS OF ULTRASONOGRAPHY AND MAMMOGRAPHY				L	T	P	C
Year	II	Semester	IV				2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil							
Course Objectives	The objective is to learn basic knowledge of ultrasound and Doppler equipment for various imaging and equipment used for breast imaging and mammography techniques.									

Course Outcomes	
CO1	Students will be able to learn about Sound and Ultrasound Imaging.
CO2	Students will be able to learn about USG equipment, Transducers and Piezoelectric crystals.
CO3	Students will be able to learn about USG Display Modes.
CO4	Students will be able to learn about Doppler USG and Mammography.
CO5	Students will be able to learn about Clinical aspects of USG and Mammography.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION TO ULTRASOUND IMAGING	Sound, Ultrasound, Attenuation, Echoes, Basic principle of Ultrasound imaging, Advantages and disadvantages.	6	CO1
2	INSTRUMENTATION OF ULTRASONOGRAPHY	Controls of Ultrasound Equipment, USG probes, Coupling agent, Cathode ray tube, Image display, USG contrast agent. Piezoelectric Effect - Definition, Types of elements, Properties. Transducers : Construction and operation, Types of transducers.	6	CO2
3	USG DISPLAY MODES	USG Display modes : A mode, B mode, M mode, TM mode. Gray scale imaging Beam focusing, Resolution	6	CO3
4	DOPPLER USG	Principle, Doppler Effect, Color Doppler, Continuous wave Doppler, Pulsed wave Doppler. USG Bio effects, safety. Mammography : Mammography Equipment and Basic views in Mammography.	6	CO4
5	CLINICAL PRACTICE	Scanning protocol, Indication, Patient preparation, image quality and artifacts in Ultrasound and Mammography.	6	CO5

Reference Books:	
1.	Zwiebel WJ, Sohaey R. Introduction to ultrasound. WB Saunders Company;1998.
2.	Hagen-Ansert SL. Textbook of diagnostic ultrasonography. Mosby Elsevier;2006.
3.	Basics of Ultrasonography for Radiographers and Technologists- Latest edition
4.	Tucker AK, Ng YY. Textbook of mammography. Churchill Livingstone; 2001.
5.	Wentz G, Parsons WC. Mammography for radiologic technologists. McGraw-Hill, Health Professions Division; 1997
e-Learning Source:	
1.	https://medlineplus.gov/lab-tests/sonogram
2.	https://www.radiologyinfo.org/en/info/mammo
3.	https://en.wikipedia.org/wiki/Doppler_ultrasonography

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
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

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

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT212	BASICS OF ULTRASONOGRAPHY AND MAMMOGRAPHY	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT213	Title of the Course	BASICS OF COMPUTED TOMOGRAPHY	L	T	P	C
Year	II	Semester	IV	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to induce idea on cross sectional imaging of different anatomical area along with the pathologies.						

Course Outcomes	
CO1	Students will be able to learn about CT scan and its generations.
CO2	Students will be able to learn about instruments of CT scan.
CO3	Students will be able to learn about Image reconstruction, Image quality and CT number.
CO4	Students will be able to learn about CT artifacts.
CO5	Students will be able to learn about Clinical aspects and post processing technique of CT scan.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	INTRODUCTION AND PRINCIPLE OF CT SCAN	History, Advantage and Disadvantages of CT, Basic principle of CT. Generations of Computed Tomography- 1st generation, 2nd generation, 3 rd generation, Slip ring technology, 4th generation, Electron beam CT, Dual Source CT, Flat Panel Detector CT Single and Multi-slice Technology.	6	CO1
2	INSTRUMENTATION	CT scanner gantry, Detectors & Data Acquisition System, Generator, Computer and image processing. System Image display system, storage, recording and communication system, CT control console, Options and accessories for CT systems	6	CO2
3	IMAGE RECONSTRUCTION, IMAGE DISPLAY AND IMAGE QUALITY	Image Reconstruction- Basic principle, Reconstruction algorithms, Image reconstruction from projections, Types of data reconstruction. Image Display and Image Quality Image formation and representation, Image processing, Pixel and voxel, CT number Window level and window width, Qualities, Resolution, Contrast, Sharpness, Noise properties in CT.	6	CO3
4	CT ARTEFACTS	CT Artefacts- Classification, Types, Causes, Remedies	6	CO4
5	DIAGNOSTIC ASPECTS OF CT AND POSTPROCESSING TECHNIQUES	Diagnostic aspects of CT and post Processing Techniques HRCT, Isotropic imaging, Patient management, Patient preparation, positioning, Technologist role, Protocols for whole body imaging Clinical applications of CT, 2D & 3D imaging, MPR, SSD, Volume Rendering, BMD.	6	CO5

Reference Books:	
1.	Zwiebel WJ, Sohaey R. Introduction to ultrasound. WB Saunders Company;1998.
2.	Hagen-Ansert SL. Textbook of diagnostic ultrasonography. Mosby Elsevier;2006.
3.	Basics of Ultrasonography for Radiographers and Technologists- Latest edition
4.	Tucker AK, Ng YY. Textbook of mammography. Churchill Livingstone; 2001.
5.	Wentz G, Parsons WC. Mammography for radiologic technologists. McGraw-Hill,Health Professions Division; 1997
e-Learning Source:	
1.	https://www.slideshare.net/shreyacathe/ct-scan-62017319
2.	https://www.slideshare.net/ganesahyogananthem/ct-artifact
3.	https://en.wikipedia.org/wiki/High-resolution_computed_tomography

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
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

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

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT213	BASICS OF COMPUTER TOMOGRAPHY	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT214	Title of the Course	ORIENTATION IN PAR CLINICAL SCIENCES	L	T	P	C
Year	II	Semester	IV	2	1	0	3
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to learn basic pathological conditions related to cardiology, surgery, nephrology, orthopedic, gastrology, neurology and general medicine for the diagnosis.						

Course Outcomes	
CO1	Students will be able to learn about disease of circular and respiratory system.
CO2	Students will be able to learn about pathological conditions of GIT.
CO3	Students will be able to learn about disease of the Urinary system.
CO4	Students will be able to learn about Pathologies of skeletal system.
CO5	Students will be able to learn about some common pathologies of human body.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	DISEASE OF CIRCULAR AND RESPIRATORY	1. Pericarditis, Valvular diseases, Rheumatic Heart Disease, Heart failure 2. Bronchitis, Emphysema, Bronchitis, Pneumonia, Tuberculosis, Pleura effusion, Pneumothorax	6	CO1
2	DISEASE OF GIT	1. Aclasia cardia, Peptic ulcer, Intestinal obstruction, Ulcerative colitis, Pancreatitis, Portal Hypertension, Ascites, Cholecystitis, Melena, Appendicitis	6	CO2
3	DISEASE OF THE URINARY SYSTEM	1. Hematuria, UTI, Hydronephrosis, Horseshoe Kidney, Hydrocele, Glomerulonephritis, Nephrotic Syndrome, Urinary calculi, Polycystic Kidney disease, Renal failure	6	CO3
4	PATHOLOGICAL CONDITIONS OF THE SKELETAL SYSTEM	1. Fracture, Type Mechanism, Healing, Delayed Union, Non- complication 2. Injuries of the shoulder girdle, Dislocation of the shoulder 3. Injuries of the carpal 4. Dislocation of Hip 5. Fracture of Femur, Tibia, Ankle, calcaneum 6. Acute & chronic osteoarthritis 7. Rheumatoid arthritis, Paget's Disease, Ankylosing spondylitis, Club foot, Perthes disease, Bone Tumour-Benign Malignant	6	CO4
5	OTHER PATHOLOGY	1. Cholelithiasis, Peritonitis, Suprahrenic Abscess, Benign Hypertrophy prostate	6	CO5

Reference Books:

- 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.
- Davies SG, Chapman S. Aids to radiological differential diagnosis. Elsevier Health Sciences; 2013 Nov 20.
- Krishnamurthy, Medical Radiographic Technique & Darkroom Practice.

e-Learning Source:

- <https://www.mayoclinic.org/diseases-conditions/hydronephrosis/cdc-20397563>
- <https://medlineplus.gov/heartfailure.html>
- <https://medlineplus.gov/fractures.html#:~:text=Patient%20Handouts-,Summary,cause%20weakening%20of%20the%20bones>

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
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

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

Course Code	Course Title	Attributes & SDGs							SDGs No.
		Attributes							
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT214	ORIENTATION IN PAR CLINICAL SCIENCES			√					3,4, 11



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT215	Title of the Course	CONVENTIONAL RADIOGRAPHIC TECHNIQUES-PART II LAB	L	T	P	C
Year	II	Semester	IV	0	0	2	1
Pre-Requisite	NIL	Co-requisite	Nil				
Course Objectives	The main objective is to aware the student about conventional technique of radio imaging technique like (manual image processing & fluoroscopy / dynamic imaging) along with image formation, developing and reading and also handling the equipments.						

Course Outcomes	
CO1	Students will be able to learn about portable, Mobile and C-Arm machines of radiology.
CO2	Students will be able to learn about fluoroscopy.
CO3	Students will be able to learn about X-ray and fluoroscopy tables.
CO4	Students will be able to learn about tomography equipment.
CO5	Students will be able to learn about cranial and dental radiography.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	PORTABLE & MOBILE EQUIPMENT	Portable & Mobile Equipment	4	CO1
2	FLUOROSCOPY EQUIPMENT	Fluoroscopy Equipment	4	CO2
3	FLUOROSCOPIC/ RADIOGRAPHIC TABLES	Fluoroscopic / Radiographic Tables	4	CO3
4	TOMOGRAPHIC EQUIPMENT	Tomographic Equipment	4	CO4
5	EQUIPMENT FOR CRANIAL AND DENTAL RADIOGRAPHY	Equipment for Cranial And Dental Radiography	4	CO5

Reference Books:	
1.	Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic cardiology. Lippincott Williams & Wilkins; 1990.
2.	Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.
3.	Curry TS, Dowdey JE, Murray RC. Introduction to the physics of diagnostic radiology.
4.	Adam A, Dixon AK, Gillard JH, Schaefer-Prokop C, Grainger RG, Allison DJ. Grainger & Allison's Diagnostic Radiology E-Book. Elsevier Health Sciences.
5.	D N and M O Chesney- X ray equipments for student radiographers- Thirdedition
6.	Burgener FA, Korman M. Differential diagnosis in conventional radiology

e-Learning Source:	
1.	https://youtu.be/R2-GB65Wa5w
2.	https://youtu.be/JDYG-JE16kJ
3.	https://youtu.be/ThjvbEnlRrM

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
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

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

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT215	CONVENTIONAL RADIOGRAPHIC TECHNIQUES-PART II LAB	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT216	Title of the Course	SPECIAL RADIOGRAPHIC PROCEDURES- LAB	L	T	P	C
Year	III	Semester	IV	0	0	2	1
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to learn contrast-imaging techniques under the guidance of fluoroscopy, administration of contrast media and its safety aspect.						

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 and HSG.
CO4	Students will be able to learn about Nervous system and hepatobiliary & Sialography, DCG, Sinogram, FNAC and Biopsy.
CO5	Students will be able to learn about positioning, patient preparation, assistance while performing procedures.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	RADIOGRAPHIC PROCEDURES	Radiography of Special radiological procedures, using contrast media as per syllabus.	10	CO1, CO2, CO3, CO4
2	PATIENT PREPARATION	Positioning, Patient preparation, assistance while performing procedures.	10	CO5

Reference Books:	
1.	Lakhkar B N, Banavali S, Shetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.
2.	Snopek AM. Fundamentals of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.
3.	Davies SG, Chapman S. Aids to radiological differential diagnosis. Elsevier Health Sciences; 2013 Nov 20.
4.	Krishnamurthy, Medical Radiographic Technique & Darkroom Practice

e-Learning Source:	
1.	https://youtu.be/IYfL-V2C9Uw
2.	https://youtu.be/zY12G2Z_T7M
3.	https://youtu.be/JQW9RilqUaw

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
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

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT216	SPECIAL RADIOGRAPHIC PROCEDURES- LAB	√	√	√	√				3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT217	Title of the Course	BASICS OF COMPUTED TOMOGRAPHY- LAB	L	T	P	C
Year	II	Semester	IV	0	0	2	1
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective is to induce idea on cross sectional imaging of different anatomical area along with the pathologies.						

Course Outcomes: After the successful course completion, learners will develop the following attributes:	
CO1	Students will be able to learn about CT scan non-contrast procedures.
CO2	Students will be able to learn about patient preparation and positioning in CT scans.
CO3	Students will be able to learn about radiation protection during CT scan.
CO4	Students will be able to learn about care of patient and management during contrast CT scans.
CO5	Students will be able to learn about post procedure techniques and care of patients after contrast CT scan.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	NON-CONTRAST CT SCAN	1. Patient preparation, patient positioning, performing all non-contrast and contrast computed tomography procedures.	6	CO1, CO2
2	CONTRAST CT SCAN	2. Radiation protection and care of patient during procedures including contrast media Management in CT.	6	CO3, CO4
3	POST PROCEDURE TECHNIQUES	3. Various post processing techniques and evaluation of image quality and clinical findings. Post procedural care of the patient	8	CO5

Reference Books:	
1.	Seeram E. Computed Tomography-E-Book: Physical Principles, Clinical.
2.	Applications and Quality Control. Elsevier Health Sciences; 2015 Sep 2.
3.	Seeram E. Computed tomography: physical principles and recent technical advances.
4.	Journal of Medical Imaging and Radiation Sciences. 2010.
5.	Kak AC, Slaney M. Principles of computerized tomographic imaging. Society for Industrial and Applied Mathematics; 2001 Jan 1.
6.	Hsieh J. Computed tomography: principles, design, artifacts, and recent advances.
7.	SPIE press; 2003.
8.	Shaw CC, editor. Cone beam computed tomography. Taylor & Francis; 2014 Feb 14.
e-Learning Source:	
1.	https://www.slideshare.net/shreyacathe/ct-scan-62017319
2.	https://www.slideshare.net/ganesahyogananthem/ct-artifact
3.	https://en.wikipedia.org/wiki/High-resolution_computed_tomography

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
	CO1	3	3	3	3	2	2	3	3	3	3	3	2	2	2
CO2	2	3	2	2	3	3	3	3	2	3	3	2	2	3	3
CO3	3	2	3	2	3	2	3	3	2	2	3	3	2	3	3
CO4	2	3	2	3	3	3	2	3	3	2	3	3	2	3	3
CO5	2	3	3	3	2	3	2	3	2	3	2	3	2	3	2

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

Course Code	Course Title	Attributes							SDGs No.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RT217	BASICS OF COMPUTED TOMOGRAPHY- LAB	√	√	√	√		√	√	3,4



Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	RT218	Title of the Course	HOSPITAL POSTING	L	T	P	C
Year	II	Semester	IV	0	0	14	7
Pre-Requisite	Nil	Co-requisite	Nil				
Course Objectives	The objective of the hospital posting is to learn about patient handling, radiation protection and procedures done in the department.						

Course Outcomes: After the successful course completion, learners will develop the 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 No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	CLINICAL POSTING	Students shall be deputed to various labs of the Radiology department wherein they shall undergo practical training of handling patients, collection and processing of data, samples, radiograph, & probable diagnosis. Identification of patient's particulars based on CR number, Lab Number. Process of performing various tests in different lab, like CT labs, USG Labs, MRI Lab, X-ray lab. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.	140	CO1, CO2, CO3, CO4, CO5

Reference Books:

1. Seeram E. Computed Tomography-E-Book: Physical Principles, Clinical.
2. Applications and Quality Control. Elsevier Health Sciences; 2015 Sep 2.
3. Lakhkar B N, Banavali S, Shetty C. Radiological quiz-head and neck. Indian Journal of Radiology and Imaging.
4. Snopek AM. Fundamentals of Special Radiographic Procedures-E-Book. Elsevier Health Sciences; 2013 Aug 13.
5. Curry TS, Dowdey JE, Murry RC. Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins; 1990.
6. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar 20.
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. https://en.wikipedia.org/wiki/High-resolution_computed_tomography
2. <https://youtu.be/IhjbvEnLRrM>
3. https://en.wikipedia.org/wiki/Doppler_ultrasonography

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
RT218	HOSPITAL POSTING	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	3,4
		√	√	√	√		√	√	