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: III/V

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

Program: B.Sc. RIT Semester-V

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	RT301	Magnetic Resonance Imaging	Core	3	1	0	40	20	60	40	100	3:1:0	4
2	RT302	Hospital Practice & Care of Patient	Core	3	1	0	40	20	60	40	100	3:1:0	4
3	RT303	Orientation in Clinical Sciences	Core	3	1	0	40	20	60	40	100	3:1:0	4
4	RT304	Basic Preventive Medicine & Community Health Care	Core	2	1	0	40	20	60	40	100	2:1:0	3
PRACTICAL													
1	RT305	Magnetic Resonance Imaging-Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
2	RT306	Hospital Practice & Care of Patient -Lab	Core	0	0	4	40	20	60	40	100	0:0:2	2
3	RT307	Hospital Posting-Lab	Core	0	0	14	40	20	60	40	100	0:0:7	7
Total				**11**	**04**	**20**	**280**	**140**	**420**	**280**	**700**	**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	RT301	Magnetic Resonance Imaging	Core	√	√	√			√	√	3,4
2	RT302	Hospital Practice & Care of Patient	Core	√	√	√	√		√	√	3,4
3	RT303	Orientation in Clinical Sciences	Core	√	√	√	√		√	√	3,4
4	RT304	Basic Preventive Medicine & Community Health Care	Core	√	√	√	√		√	√	3,4
PRACTICAL											
1	RT305	Magnetic Resonance Imaging-Lab	Core	√	√	√	√		√	√	3,4
2	RT306	Hospital Practice & Care of Patient -Lab	Core	√	√	√	√		√	√	3,4
3	RT307	Hospital Posting-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: 2019-20							
Course Code	**RT301**	**Title of the Course**	**MAGNETIC RESONANCE IMAGING**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**3**	**1**	**0**	**4**
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 different pathologies related to musculoskeletal, soft tissue imaging.						

Course Outcomes	
CO1	Students will have abundant Knowledge on Principal, Instrumentation, and application of MRI.
CO2	Students will have abundant Knowledge on MRI hardware and Software.
CO3	Students will have abundant Knowledge on Imaging Sequences (pulse sequences, Gradient Sequences, Angiography).
CO4	Students will have abundant Knowledge on MRI Artifacts and MRI Contrast agents.
CO5	Students will have abundant Knowledge on Quality assurance and Controls.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**INTRODUCTION AND BASIC PRINCIPLE OF MAGNETIC RESONANCE IMAGING**	History of MRI, Electricity & Magnetism, Laws of magnetism, atomic structure, Motion within the atom, The Hydrogen nucleus, Precession, Larmor equation, Resonance, MR signal, Free induction decay signal, Relaxation, T1 recovery, T2 decay, Pulse timing& parameters.	8	CO1
2	**MRI HARDWARE, ENCODING, DATA COLLECTION & IMAGE FORMATION**	1. **MRI Hardware:** Introduction, Permanent magnets, Electromagnets, Super conducting magnets, Fringe fields, Shim coils, Gradient coils, Radio-frequency coils, the pulse control units, Patient transportation system, Operator interface. 2. **Encoding, Data collection & Image formation:** Introduction, Gradients, Slice selection, Frequency encoding, Phase encoding; Scan timing, Sampling, data space, k-space, k-space filling and fast Fourier transformation.	8	CO2
3	**PULSE SEQUENCES, MRI PARAMETERS & TRADE OFFS**	1. **Pulse sequences:** Introduction To basic pulse sequences. Spin echo sequences, Conventional spin echo, Fast spin echo, Inversion recovery, STIR, FLAIR Proton Density Imaging, Gradient echo pulse sequences Conventional gradient echo**,** The study state, SSFP**,** Coherent residual transverse magnetization**,** Incoherent residual transverse magnetization**,** Ultra- fast imaging, Advanced imaging techniques, EPI. 2. **MRI parameters & Tradeoffs:** Introduction, Signal to Noise Ratio (SNR) & how to increase SNR, Contrast to Noise Ratio (CNR), Spatial resolution & how to increase the spatial resolution, Scan time & how to reduce time, Tradeoffs, Decision making, Volume imaging.	8	CO3
4	**MRI ARTE FACTS, MRI CONTRAST AGENTS**	**MRI Arte facts:** Introduction, Phase miss-mapping, Aliasing or wrap around, Chemical shift artifact, Chemical miss registration, Truncation artifact/Gibbs phenomenon, Motion of the patient Magnetic susceptibility artifact, Magic angle artifact, Zipper artifact, shading artifact Cross excitation and cross talk. **MRI contrast agents.**	8	CO4
5	**FLOW PHENOMENA & MRI ANGIOGRAPHY**	1. **Flow Phenomena & MRI angiography:** Introduction, The mechanisms of flow, Time of flight phenomenon, Entry slice phenomenon, Intra voxel Dephasing. **Flow phenomena compensation**-Gradient moment rephrasing, Pre saturation, Even echo rephrasing, MR Angiography. 2. **Clinical Applications, Scanning Protocols and Safety aspects:** Protocols for whole body imaging, The main magnetic field, Gradient magnetic field, Radiofrequency fields, Projectiles, Implants and prostheses, Pacemakers, Medical emergencies, Patient monitoring, Monitors and devices in MRI Claustrophobia, Quenching, Safety tips, Layout planning.	8	CO5

Reference Books:

1. Mc Robbie DW, Moore EA, Graves MJ. MRI from Picture to Proton. Cambridge university press; 2017 Apr13.
2. Huettel SA, Song AW, McCarthy G. Functional magnetic resonance imaging. Sunderland: Sinauer Associates; 2004 Apr1.
3. Westbrook, Catherine, and Carolyn Kaut Roth. MRI in Practice. John Wiley &Sons.
4. Westbrook, Catherine. Handbook of MRI technique. John Wiley & Sons,2014.
5. Möller, Torsten B., and Emil Reif. MRI parameters and positioning. Thieme,2010.
6. Dale BM, Brown MA, Semelka RC. MRI: basic principles and applications. John Wiley & Sons; 2015 Aug6
7. MRI in practice by Catherine Westbrook and John Talbot.
8. MRI physical and biological principles by Stewart Carlyle bushing and Geoffrey Clarke.

e-Learning Source:

1. https://www.mayoclinic.org/tests-procedures/mri/about/pac-20384768
2. https://www.nhs.uk/conditions/mri-scan

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	2	3
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	
RT301	MAGNETIC RESONANCE IMAGING	√	√	√			√	√	3,4

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT302**	**Title of the Course**	**HOSPITAL PRACTICE & CARE OF PATIENT**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**3**	**1**	**0**	**4**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn about the assessment and handling emergencies in the department as well as the infection controls amongst self and the patient.						

Course Outcomes	
CO1	Students have the Knowledge on Patients Care and Assessment, Communication with Patients as well as taking patents history and consents.
CO2	Students have the Knowledge on handling patients in different conditions.
CO3	Students have the Knowledge on Sterilization techniques, medication administration and infection controls.
CO4	Students have the Knowledge on Infection Control.
CO5	Students have the Knowledge on Patient Education & Communication problems explanation of Examinations.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Patient care and Assessment**	**Patient care and Assessment:** Taking history, assessing current physical status, Skin temperature, color, consciousness, Breathing, Obtaining Vital signs, Electronic Patient Monitoring.	8	CO1
2	**Responsibilities of the Imaging Technologist. Patient transfer technique &Restraint technique**	**Responsibilities of the Imaging Technologist-** Medication administration, routes of administration, List of frequently used medications. **Patient transfer technique &Restraint technique-** Preparation for transfer, wheelchair transfer, stretcher transfer, immobilization techniques.	8	CO2
3	**Handling the emergencies in Radiology. Patient care during Investigation**	**Handling the emergencies in Radiology-** Reaction to contrast media, Oxygen administration and suction, Respiratory emergencies, Cardiac emergencies, Trauma, Shock. **Patient care during Investigation -** G.I. Tract, Biliary tract, Respiratory tract, Gynecology, Cardiovascular, Lymphatic system, C.N.S. etc.	8	CO3
4	**Infection Control**	**Infection Control**: Microorganism- Bacteria, Viruses, Fungi, Prions, Protozoa Cycle of Infection, Immunity, Infectious disease Transmission modes Isolation techniques, Sterilization & sterile techniques.	8	CO4
5	**Patient Education & Communication**	**Patient Education & Communication-** Patient communication problems Explanation of examinations, Radiation Safety / Protection Interacting with terminally ill patient Informed Consent.	8	CO5

Reference Books:

1. Ehrlich RA, Coakes DM. Patient Care in Radiography-E-Book: With an Introduction to Medical Imaging. Elsevier Health Sciences; 2016 Jan19.
2. Bontrager KL, Lampignano J. Textbook of Radiographic Positioning and Related Anatomy-E- Book. Elsevier Health Sciences; 2013 Aug7.
3. Grol R, Wensing M, Eccles M, Davis D, editors. Improving patient care: the implementation of change in health care. John Wiley & Sons; 2013 Mar18.
4. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar20.

e-Learning Source:

1.https://www.chcollege.org/meaning-of-patient-care
2.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1705904

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	3
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	3	2	3	2
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	2

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
RT302	HOSPITAL PRACTICE & CARE OF PATIENT	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT303**	**Title of the Course**	**ORIENTATION IN CLINICAL SCIENCES**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**3**	**1**	**0**	**4**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn basic medical pathologies for the image interpretation and diagnosis.						

Course Outcomes	
CO1	Students will have the Knowledge regarding meningitis, polyps, sinusitis etc. diseases
CO2	Students will have the Knowledge regarding Aneurysm, Shock, Hypertension etc. diseases
CO3	Students will have the Knowledge about regarding Hangman's fracture, IVDP, Discitis etc. disease
CO4	Students will have the Knowledge about regarding Hematochezia, Anemia etc. diseases
CO5	Students will have the Knowledge about regarding COPD, Asthma, Hematochezia disease etc. diseases

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Pathological condition of Nervous system and ENT**	Meningitis Cerebral Vascular Disorders, Encephalitis, Sinusitis, Polyps, DNS, Otitis Media, Tonsillitis, CSF Rhinorrhea.	8	CO1
2	**Pathological condition of Brain**	Aneurysms, Arachnoids cysts, Alzheimer's, Parkinson's Shock, Hypertension, Embolism, Hemorrhage.	8	CO2
3	**Pathological condition of Spine**	Hangman's fracture, Discitis, Spondylitis, IVDP, Scoliosis, Pott's, TB Spine, Kyphosis.	8	CO3
4	**Pathological condition of lungs, Blood and intestine**	Hematochezia, Anemia, Leukemia, Epilepsy, COPD, Asthma, Emphysema.	8	CO4
5	**Pathological condition of Liver and other conditions.**	Hepatitis, Diabetes Mellitus, Varicose Vein, DVT, Obstetrics – Diagnosis of Pregnancy.	8	CO5

Reference Books:

1. Das KK. Textbook of medicine, Volumes 1 and 2. Jaypee Brothers Medical Publishers 2. (P) Ltd; 2002.
2. Mercier L. Practical Orthopedics E-Book. Elsevier Health Sciences; 2008 May16.
3. Shenoy RM. Essentials of orthopedics. Jaypee Brothers, Medical Publishers Pvt. Limited; 2015.
4. Kumar V, Abbas AK, Fausto N, Aster JC. Robbins and Cotran Pathologic Basis of Disease, Professional Edition E-Book. Elsevier Health Sciences; 2014 Aug27.
5. Mohan H. Textbook of pathology. New Delhi: Jaypee brother's medical publishers.
6. Boyd W. A Textbook of Pathology: An Introduction to Medicine. Academic Medicine.
7. Davidsohn I, Henry JB, Todd JC. Todd-Sanford clinical diagnosis by laboratory methods

e-Learning Source:

1.https://www.cdc.gov/meningitis/index.html#:~:text=Meningitis%20is%20an%20inflammation%20(swelling,infections%20also%20can%20cause%20meningitis.

2. https://www.hopkinsmedicine.org/health/conditions-and-diseases/otitis-media#:~:text=Otitis%20media%20is%20inflammation%20or,sore%20throat%2C%20or%20respiratory%20infection.

	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	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	2	3	2
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

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
RT303	ORIENTATION IN CLINICAL SCIENCES	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT304**	**Title of the Course**	**BASIC PREVENTIVE MEDICINE AND COMMUNITY HEALTH CARE**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	This curriculum imparts the knowledge of various types of diseases and functioning of various Health Program.						

Course Outcomes	
CO1	Student will have the knowledge of health, important public health acts etc.
CO2	Student will have the knowledge on communicable disease
CO3	Student will have the knowledge on functioning of various Health Programs.
CO4	Student will have the knowledge on Population, problems of population growth, birth rates, death rates etc.
CO5	Student will have the knowledge on Family welfare and planning.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Health**	Definition and concepts of health, important public health acts, health problems of developed and developing countries, environment and health. Definition and concepts of epidemiology, diseases, types and use of epidemiology. Basic emergency care and first aid.	6	CO1
2	**Introduction to Communicable disease**	Epidemiology, etiology, pathogenesis and control of communicable disease like malaria, cholera, tuberculosis, leprosy, diarrhea, poliomyelitis, viral hepatitis, measles, dengue, rabies, AIDS.	6	CO2
3	**National Health Policy and Programs**	National Health Policy and Programs, DOTS, National AIDS control programme, National cancer control programme, universal immunization programme etc. Nutrition and major nutritional problems, etiology, manifestations and prevention, components of RCH care. Examination of water, food adulteration, role of regular exercise and yoga in prevention and management of various diseases.	6	CO3
4	**Introduction to Population and hygiene**	Population, problems of population growth, birth rates, death rates, fertility rates, MMR., CPR, Approaches and methods of contraception, Reproductive and child health. Hygiene and sanitation, sanitation barriers, excreta disposal.	6	CO4
5	**Various Immunization Programs and regulatory bodies**	Immunization program, various national immunization programs and vaccine schedules, Family welfare and planning, communicable and non-communicable disease, Health planning in India including various committees, national health policy and health goals. Objectives and goals of WHO, UNICEF, Indian Red Cross Society, UNFPA, FAO, ILO	6	CO5

Reference Books:

1. K. Parks & Sunder Lal, (2015), Textbook of Preventive Social Medicine,3rd edition, Bhanot Publications.
2. Harsh Mohan (2017), Textbook of Pathology,7th edition, Jaypee Publications

e-Learning Source:

1.https://www.who.int/

2. https://main.mohfw.gov.in/

	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	3
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	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	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	
RT304	BASIC PREVENTIVE MEDICINE AND COMMUNITY HEALTH CARE	√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT305**	**Title of the Course**	**MAGNETIC RESONANCE IMAGING - LAB**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**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 different pathologies related to musculoskeletal, soft tissue imaging.						

Course Outcomes	
CO1	Students will have abundant Knowledge on Principal, Instrumentation, and application of MRI.
CO2	Students will have abundant Knowledge on MRI hardware and Software.
CO3	Students will have abundant Knowledge on Imaging Sequences (pulse sequences, Gradient Sequences, Angiography).
CO4	Students will have abundant Knowledge on MRI Artifacts and MRI Contrast agents.
CO5	Students will have abundant Knowledge on Quality assurance and Controls.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Patient Preparation & MRI Procedures**	Patient preparation, patient positioning, performing all non-contrast and contrast MRI procedures.	5	CO1
2	**MRI Protocols**	Planning of different scanning planes, parameters and their tradeoffs & patient monitoring during the procedures.	5	CO2
3	**Image Processing**	Various post processing techniques and evaluation of image quality and clinical findings.	5	CO3
4	**Patient Care**	Post procedural care of the patient.	5	CO4

Reference Books:

1. McRobbie DW, Moore EA, Graves MJ. MRI from Picture to Proton. Cambridge university press; 2017 Apr 13.
2. Huettel SA, Song AW, McCarthy G. Functional magnetic resonance imaging. Sunderland: Sinauer Associates; 2004 Apr 1.
3. Westbrook, Catherine, and Carolyn Kaut Roth. MRI in Practice. John Wiley & Sons.
4. Westbrook, Catherine. Handbook of MRI technique. John Wiley & Sons, 2014.
5. Möller, Torsten B., and Emil Reif. MRI parameters and positioning. Thieme, 2010.
6. Dale BM, Brown MA, Semelka RC. MRI: basic principles and applications. John Wiley & Sons; 2015 Aug

e-Learning Source:

1.https://www.mayoclinic.org/tests-procedures/mri/about/pac-20384768

2.https://www.nhs.uk/conditions/mri-scan/

	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	3
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	3	2	3	2
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	2

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

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
RT305	MAGNETIC RESONANCE IMAGING - LAB	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT306**	**Title of the Course**	**HOSPITAL PRACTICE & CARE OF PATIENT- LAB**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**0**	**0**	**4**	**2**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn about the assessment and handling emergencies in the department as well as the infection controls amongst self and the patient.						

Course Outcomes	
CO1	Student will have the knowledge of vital signs and how to measure them
CO2	Student will have the knowledge of Oxygen therapy and devices
CO3	Student will have the knowledge of artificial respiration and resuscitation.
CO4	Student will have the knowledge on administration of drugs and contrast media
CO5	Student will have the knowledge on aseptic and sterile procedures.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Vital Signs**	1. To measure Body temp, respiratory rate, pulse, blood pressure:	8	CO1
2	**Oxygen Therapy**	2. Oxygen therapy, oxygen devices.	8	CO2
3	**Artificial respiration and resuscitation**	3. Artificial respiration and resuscitation.	8	CO3
4	**Supervision of Patient**	4. Supervision of patients undergoing special examination.	8	CO4
5	**Drugs administration and Contrast media**	5. Administration of drugs and contrast media.	8	CO5
6	**Aseptic and sterile procedure**	6. Aseptic and sterile procedures.	8	CO6

Reference Books:

1. Ehrlich RA, Coakes DM. Patient Care in Radiography-E-Book: With an Introduction to Medical Imaging. Elsevier Health Sciences; 2016 Jan 19.
2. Bontrager KL, Lampignano J. Textbook of Radiographic Positioning and Related Anatomy-E- Book. Elsevier Health Sciences; 2013 Aug 7.
3. Grol R, Wensing M, Eccles M, Davis D, editors. Improving patient care: the implementation of change in health care. John Wiley & Sons; 2013 Mar 18.
4. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar 20

e-Learning Source:

1.https://www.chcollege.org/meaning-of-patient-care
2.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1705904

	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	2	3
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.**
RT306	HOSPITAL PRACTICE & CARE OF PATIENT-LAB	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT307**	**Title of the Course**	**HOSPITAL POSTING- LAB**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**0**	**0**	**14**	**7**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective of this course is to inculcate the student with the knowledge of different modalities and patient handling.						

Course Outcomes	
CO1	Students will have the knowledge of patient handling.
CO2	Students will have the knowledge of identification of patient.
CO3	Students will have the knowledge about various departmental tests
CO4	Students will maintain a logbook.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Practical training of handling patients**	1. Students shall be deputed to various labs of Radiology department wherein they shall undergo practical training of handling patients, collection and processing of investigation (x ray, Special procedures, CT scan, MRI, and Ultrasound etc.) and equipment.	35	CO1
2	**Identifications of patient**	2. Identification of patient's particulars based on CR number, Lab Number and transfer of patients to different Radiology labs.	35	CO2
3	**Radiological Tests**	3. Process of performing various tests in different Radiology labs.	35	CO3
4	**Posting Logbook**	4. 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.	35	CO4

Reference Books:

1.Ehrlich RA, Coakes DM. Patient Care in Radiography-E-Book: With an Introduction to Medical Imaging. Elsevier Health Sciences; 2016 Jan 19.

2. Bontrager KL, Lampignano J. Textbook of Radiographic Positioning and Related Anatomy-E Book. Elsevier Health Sciences; 2013 Aug 7.

3. Grol R, Wensing M, Eccles M, Davis D, editors. Improving patient care: the implementation of change in health care. John Wiley & Sons; 2013 Mar 18

4. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar 20.1

e-Learning Source:

1.https://www.chcollege.org/meaning-of-patient-care

2.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1705904

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	3
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	3	2	3	2
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	2

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
RT307	HOSPITAL POSTING-LAB	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**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: III/VI

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

Program: B.Sc. RIT Semester-VI

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	RT308	Advance CT/'MRI & USG	Core	3	1	0	40	20	60	40	100	31:0	4
2	RT309	Nuclear Medicine Technology & PET Scan	Core	3	1	0	40	20	60	40	100	3:1:0	4
3	RT310	Interventional Procedure & Emergency Drugs	Core	3	1	0	40	20	60	40	100	3:1:0	4
4	RT311	Research Methodology & Biostatics	Core	3	1	0	40	20	60	40	100	2:1:0	4
PRACTICAL													
1	RT312	Advance CT/'MRI & USG -Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
2	RT313	Nuclear Medicine Technology & PET Scan-Lab	Core	0	0	4	40	20	60	40	100	0:0:2	2
3	RT314	Hospital Posting-Lab	Core	0	0	12	40	20	60	40	100	0:0:6	6
Total				**12**	**04**	**18**	**280**	**140**	**420**	**280**	**700**	**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	RT308	Advance CT/'MRI & USG	Core	√	√	√	√		√	√	3,4
2	RT309	Nuclear Medicine Technology & PET Scan	Core	√	√	√	√		√	√	3,4
3	RT310	Interventional Procedure & Emergency Drugs	Core	√	√	√	√		√	√	3,4
4	RT311	Research Methodology & Biostatics	Core	√	√	√	√		√	√	3,4
PRACTICAL											
1	RT312	Advance CT/'MRI & USG -Lab	Core	√	√	√	√		√	√	3,4
2	RT313	Nuclear Medicine Technology & PET Scan Lab	Core	√	√	√	√		√	√	3,4
3	RT314	Hospital Posting-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: 2019-20							
Course Code	**RT308**	**Title of the Course**	**ADVANCE CT/MRI & USG**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	**3**	**1**	**0**	**4**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn about the recent advancements & new imaging modalities. Outline of advanced CT/ MRI/ USG & Doppler.						

Course Outcomes	
CO1	At the end of the course, student will have knowledge on: Latest upgraded hardware & software of different imaging modalities.
CO2	Students will have abundant Knowledge on New techniques used to achieve images for special conditions. Various post processing techniques.
CO3	Students will have Knowledge on Techniques of sonography-selection- Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- biopsy procedures, assurance to patients.
CO4	Students will have Knowledge on CT of head and neck – thorax – abdomen – pelvis – Musculo skeletal system – spine – PNS. Anatomy– clinical indications and contraindications – patient preparation – technique – contrast media-types.
CO5	Students will have abundant Knowledge on injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Helical CT Scan**	Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose	10	CO1
2	**MRI imaging methods**	MRI imaging methods – Head and Neck, Thorax, Abdomen, Musculoskeletal System imaging Clinical indications and contraindications- types of common sequences on imaging Protocols for various studies- slice section- patient preparation-positioning of the patient Plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer.	10	CO2
3	**Techniques of sonography**	Techniques of sonography -selection- Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- biopsy procedures, assurance to patients.	10	CO3
4	**CT of head and neck**	CT of head and neck – thorax – abdomen – pelvis – Musculo skeletal system – spine – PNS. Anatomy– clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.	10	CO4

Reference Books:

1. Faro SH, Mohamed FB, editors. Functional MRI: basic principles and clinical applications. Springer Science & Business Media; 2006 Nov, 22
2. Baert AL. Parallel imaging in clinical MR applications. Springer Science & Business Media; 2007 Jan 11.
3. Johansen-Berg H, Behrens TE, editors. Diffusion MRI: from quantitative measurement to in vivo neuroanatomy. Academic Press; 2013 Nov 4
4. Bernstein MA, King KF, Zhou XJ. Handbook of MRI pulse sequences. Elsevier.
5. Recent Trends in medical imaging (CT, MRI and USG)

e-Learning Source:

1. https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/computed-tomography-ct-scan#:~:text=A%20CT%20scan%20is%20a%20diagnostic%20imaging%20procedure%20that%20uses,detailed%20than%20standard%20X%2Drays
2. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/ct-scan

	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	3
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	2
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	2	3

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

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
RT308	ADVANCE CT/MRI & USG	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT309**	**Title of the Course**	**NUCLEAR MEDICINE TECHNOLOGY & PET SCAN**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	**3**	**1**	**0**	**4**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn basic basics about the radioactivity and radioactive nuclides.						

Course Outcomes	
CO1	Students will have the Knowledge about Basic principle, instrumentation and clinical application of nuclear medicine Technology.
CO2	Students will have the Knowledge about Radioactive transformation
CO3	Students will have the Knowledge about Production, handling & transportation of radio-nuclides.
CO4	Students will have the Knowledge about Equipments of NMT
CO5	Students will have the Knowledge about Equipments of NMT

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to NMT**	Introduction to NMT and Radioactive Transformation, Basic atomic and nuclear physics, History of radioactivity, Units & quantities, Isotopes, Isobars, Isomers, Radioactivity and half-life, Exponential decay, specific activity, Modes of Radioactive decay, parent daughter decay.	10	CO1
2	**Production of Radio nuclides**	Production of Radio nuclides, Reactor produced radionuclide, Reactor principles; Accelerator produced radionuclide, Radionuclide generators.	10	CO2
3	**Radio pharmacy & Handling & Transport of Radio-nuclides**	Radio pharmacy & Handling & Transport of Radio-nuclides Cold kits, Radio pharmacy used in nuclear medicine, Radiopharmaceuticals used in various procedures, Safe handling of radioactive materials, Procedures for handling spills.	10	CO3
4	**Equipments of NMT**	Equipments of NMT, Gamma camera, PET, SPECT (working principle).	10	CO4

Reference Books:

1. Cherry SR, Sorenson JA, Phelps ME. Physics in Nuclear Medicine E-Book. Elsevier Health Sciences; 2012 Feb 14.
2. Bomford CK, Miller J, Kunkler H, Sherriff IH, Bomford SB, IH Kunkler SB. Walter and Miller's textbook of radiotherapy: radiation physics, therapy, and oncology. 1993.
3. Sutton, David. "A textbook of radiology and imaging." (1987).
4. Waterstram-Rich KM, Gilmore D. Nuclear Medicine and PET/CT-E-Book: Technology and Techniques. Elsevier Health Sciences; 2016 Jul 30.
5. Bailey DL, Townsend DW, Valk PE, Maisey MN. Positron emission tomography. London: Springer; 2005

e-Learning Source:

1https://www.cdc.gov/nceh/radiation/nuclear_medicine.htm#:~:text=Nuclear%20medicine%20uses%20radioactive%20material,x%2Drays%3A%20how%20they%20work

2. https://www.iaea.org/resources/rpop/health-professionals/nuclear-medicine

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	3
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	3	3	3	2
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.**
RT309	NUCLEAR MEDICINE TECHNOLOGY & PET SCAN	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT310**	**Title of the Course**	**INTERVENTIONAL PROCEDURE & EMERGENCY DRUGS**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	**VI**	**3**	**1**	**0**	**4**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn about the special procedures done with the interventional approaches in radiology department with the help of radiological equipments.						

Course Outcomes	
CO1	At the end of the course, student will have knowledge on: 1. Equipments, procedure, technique and outcome of angiography.
CO2	At the end of the course, student will have knowledge on Drugs, contrast media &equipments of interventional radiography.
CO3	At the end of the course, student will have knowledge on Sterilized techniques and radiation protections.
CO4	At the end of the course, student will have knowledge on Sterile Techniques & Radiation Protection Laying up a sterile trolley, sterile techniques, radiation protection for staff and patient, protective devices, monitors.
CO5	At the end of the course, student will have knowledge on Interventional Procedures Cardiac, Vascular, and Nonvascular.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Interventional Radiology**	Introduction to Interventional Radiology, Contrast media & Emergency Drugs, Need for interventional procedures, Informed consent, patient care, patient preparation, Patient monitoring, role of technologist in interventional procedure Types of contrast media, method of administration, contraindication, contrast reaction management, emergency crash cart.	8	CO1
2	**Angiographic equipments and techniques**	Angiographic Equipments, Catheters & guide wires, Basics of Angiographic equipments, Single and biplane angiographic equipment, Angiographic Table, Image intensifier, Flat panel detector, electromechanical injectors, Catheters, types of catheters & guidwires, seldinger technique.	8	CO2
3	**DSA**	1. Digital Subtraction Angiography. Types, Instrumentation	8	CO3
4	**Sterile Techniques & Radiation Protection**	1. Sterile Techniques & Radiation Protection Laying up a sterile trolley, sterile techniques, radiation protection for staff and patient, protective devices, monitors.	8	CO4
5	**Interventional Procedures**	1. Interventional Procedures Interventional Procedures. Cardiac, Vascular, Nonvascular	8	CO5

Reference Books:

1. Kandarpa K, Machan L, editors. Handbook of interventional radiologic procedures. Lippincott Williams & Wilkins; 2011.
2. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar 20.
3. Valji K. The Practice of Interventional Radiology, with Online Cases and Video E-Book: Expert Consult Premium Edition-Enhanced Online Features. Elsevier Health Sciences.
4. Adam A, Dixon AK, Gillard JH, Schaefer-Prokop C, Grainger RG, Allison DJ. Grainger & Allison's Diagnostic Radiology E-Book. Elsevier Health Sciences; 2014 Jun16.
5. Kessel D, Robertson I. Interventional Radiology: A Survival Guide E-Book. Elsevier Health Sciences; 2016 Oct 22.

e-Learning Source:

1.https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/interventional-radiology#:~:text=What%20is%20interventional%20radiology%3F,ultrasound%20help%20guide%20the%20radiologist.

2.https://www.bsir.org/patients/what-is-interventional-radiology

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	3
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	2
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	2	3

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

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
RT310	INTERVENTIONAL PROCEDURE & EMERGENCY DRUGS	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT311**	**Title of the Course**	**RESEARCH METHODOLOGY & BIOSTATICS**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**3**	**1**	**0**	**4**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings. The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, in addition to being given information about the relation between data and variables.						

Course Outcomes	
CO1	Apply the principles of research and biostatistics to health practice including the design and implementation of health-related research studies.
CO2	Plan and execute a research study, including clinical trials.
CO3	Use / organize bio-statistical analysis using computers and software's and prepare reports.
CO4	Critically evaluate research activities.
CO5	Make recommendations on policy and procedures. Plan and conduct an educational session.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Research Methodology & design	Research Methodology: Introduction to research methods, identifying research problem. Ethical issues in research- Research design, Basic Concepts of Biostatistics.	8	CO1
2	Data Types	Types of Data- Research tools and Data collection methods, sampling methods, Developing a research proposal.	8	CO2
3	Biostatistics	Biostatistics: Need of biostatistics, what is biostatistics: beyond definition, understanding of data in biostatistics, how & where to get relevant data, Relation between data & variables. Type of variables: defining data set, Collection of relevant data: sampling methods	8	CO3
4	Interpretation	Normal Distribution, Standard deviation, Standard errors. Coefficient of Variation, t-test, Chi square test.	8	CO4
5	Statistical analysis	Construction of study: population, sample, normality and its beyond (not design of study, perhaps), Summarizing data on the pretext of underlined study. Understanding of statistical analysis (not methods)	8	CO5

Reference Books:

1. Statistical Methods by S.P. Gupta
2. Methods in biostatistics for medical students by B.K.Mahajan
3. RPG Biostatistics by Himanshu Tyagi

e-Learning Source:

1. https://www.youtube.com/watch?v=UtivXLO7c9A&list=PLR3kIPR1Qzzky45nZ4_1HlUCbjVNU0iZx
2. https://www.youtube.com/watch?v=txIS0N0l9xU&list=PLElbY8S8u_DK7i4Fj6Hgq8sn_l42k9H1L
3. https://www.youtube.com/watch?v=tr8M7jSlYm4

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	3
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	3	2	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	2	3	3

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
RT311	RESEARCH METHODOLOGY & BIOSTATICS	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT312**	**Title of the Course**	**ADVANCE CT/MRI & USG - LAB**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	**0**	**0**	**2**	**1**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn about the recent advancements & new imaging modalities. Outline of advanced CT/ MRI/ USG & Doppler.						

Course Outcomes	
CO1	At the end of the course, student will have knowledge on: Latest upgraded hardware & software of different imaging modalities.
CO2	Students will have abundant Knowledge on New techniques used to achieve images for special conditions. Various post processing techniques.
CO3	Students will have Knowledge on Techniques of sonography-selection- Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- biopsy procedures, assurance to patients.
CO4	Students will have Knowledge on CT of head and neck – thorax – abdomen – pelvis – Musculo skeletal system – spine – PNS. Anatomy– clinical indications and contraindications – patient preparation – technique – contrast media-types.
CO5	At the end of the course, student will have knowledge on: Latest upgraded hardware & software of different imaging modalities.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Helical CT Scan**	1. MRI Scanners: Methods of MRI imaging methods – Head and Neck	4	CO1
2	**MRI imaging method**s	2. Patient preparation-positioning of the patient –patient in MRI	4	CO2
3	**Techniques of sonography**	3. Special procedures- reconstructions- 3D images	4	CO3
4	**CT of head and neck**	4. CT of head and neck – thorax – abdomen – pelvis – Musculo skeletal system	4	CO4
5	**Helical CT Scan**	5. Patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display	4	CO5

Reference Books:

1. Faro SH, Mohamed FB, editors. Functional MRI: basic principles and clinical applications. Springer Science & Business Media; 2006 Nov 22.
2. .Baert AL. Parallel imaging in clinical MR applications. Springer Science & Business Media; 2007 Jan 11.
3. .Johansen-Berg H, Behrens TE, editors. Diffusion MRI: from quantitative measurement to in vivo neuroanatomy. Academic Press; 2013 Nov 4
4. Bernstein MA, King KF, Zhou XJ. Handbook of MRI pulse sequences. Elsevier.

e-Learning Source:

1. https://www.mayoclinic.org/tests-procedures/ultrasound/about/pac-20395177
2. https://www.portea.com/labs/diagnostic-tests/ultrasound-sonography-test-usg-abdominal-pelvic-116

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	3
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	3	2	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	2	3	3

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

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
RT312	ADVANCE CT/MRI & USG - LAB	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT313**	**Title of the Course**	**NUCLEAR MEDICINE TECHNOLOGY & PET SCAN- LAB**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	**0**	**0**	**4**	**2**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to learn basic basics about the radioactivity and radioactive nuclides.						

Course Outcomes	
CO1	Students will have the Knowledge about preparation of patient and various positioning.
CO2	Students will have the Knowledge about Technical planning.
CO3	Students will have the Knowledge about post processing techniques.
CO4	Students will have the Knowledge about post procedure care.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Patient preparation and positioning**	1. Patient preparation, patient positioning, performing all non-contrast and contrast MRIprocedures.	10	CO1
2	**Technical Planning**	2. Planning of different scanning planes, parameters and their tradeoffs & patient monitoring during the procedures.	10	CO2
3	**Post processing Techniques**	3. Various post processing techniques and evaluation of image quality and clinical findings.	10	CO3
4	**Post procedure care**	4. Post procedural care of the patient.	10	CO4

1. Faro SH, Mohamed FB, editors. Functional MRI: basic principles and clinical applications. Springer Science & Business Media; 2006 Nov 22.
2. Baert AL. Parallel imaging in clinical MR applications. Springer Science & Business Media; 2007 Jan 11.
3. Johansen-Berg H, Behrens TE, editors. Diffusion MRI: from quantitative measurement to in vivo neuroanatomy. Academic Press; 2013 Nov 4.
4. Bernstein MA, King KF, Zhou XJ. Handbook of MRI pulse sequences. Elsevier.
5. Wakefield RJ, D'Agostino MA. Essential Applications of Musculoskeletal Ultrasound in Rheumatology E-Book: Expert Consult Premium Edition. Elsevier Health Sciences.

e-Learning Source:

1. https://www.iaea.org/resources/rpop/health-professionals/nuclear-medicine
2. https://www.mayoclinic.org/departments-centers/nuclear-medicine-therapy/sections/about-nuclear-medicine-therapy/gnc-20489020

	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	3
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	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2

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

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
RT313	NUCLEAR MEDICINE TECHNOLOGY & PET SCAN- LAB	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	**RT314**	**Title of the Course**	**HOSPITAL POSTING- LAB**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	**0**	**0**	**12**	**6**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective of this course is to inculcate the student with the knowledge of different modalities and patient handling.						

Course Outcomes	
CO1	Students will have the knowledge of patient handling.
CO2	Students will have the knowledge of identification of patient.
CO3	Students will have the knowledge about various departmental tests
CO4	Students will maintain a logbook.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Practical training of handling patients**	Students shall be deputed to various labs of Radiology department wherein they shall undergo practical training of handling patients, collection and processing of investigation (X Ray, Special procedures, CT scan, MRI, Ultrasound etc.) and equipment.	30	CO1
2	**Identifications of patient**	Identification of patient's particulars based on CR number, Lab Number and transfer of patients to different Radiology labs.	30	CO2
3	**Radiological Tests**	Process of performing various tests in different Radiology labs.	30	CO3
4	**Posting Logbook**	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.	30	CO4

Reference Books:

1.Ehrlich RA, Coakes DM. Patient Care in Radiography-E-Book: With an Introduction to Medical Imaging. Elsevier Health Sciences; 2016 Jan 19.

2. Bontrager KL, Lampignano J. Textbook of Radiographic Positioning and Related Anatomy-E Book. Elsevier Health Sciences; 2013 Aug 7.

3. Grol R, Wensing M, Eccles M, Davis D, editors. Improving patient care: the implementation of change in health care. John Wiley & Sons; 2013 Mar 18

4. Brant WE, Helms CA, editors. Fundamentals of diagnostic radiology. Lippincott Williams & Wilkins; 2012 Mar 20.1

1.Ehrlich RA, Coakes DM. Patient Care in Radiography-E-Book: With an Introduction to Medical Imaging. Elsevier Health Sciences; 2016 Jan 19.

e-Learning Source:

1.https://www.chcollege.org/meaning-of-patient-care

2.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1705904

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	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CO3	3	2	3	3	3	2	3	2	2	3	2	3	3	2	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	2	3	3

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

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
RT314	HOSPITAL POSTING-LAB	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**