INTEGRAL UNIVERSITY, LUCKNOW

INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

DEPARSMENT OF PARAMEDICAL SCIENCES

BACHELOR OF MEDICAL RADIOLOGICAL IMAGING SCIENCES (BMRIS)

SYLLABUS

YEAR/ SEMESTER: III/V

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

Program: BMRIS 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	RS301	Magnetic Resonance Imaging	Core	3	1	0	40	20	60	40	100	3:1:0	4
2	RS302	Hospital Practice & Care of Patient	Core	3	1	0	40	20	60	40	100	3:1:0	4
3	RS303	Orientation in Clinical Sciences-II	Core	3	1	0	40	20	60	40	100	3:1:0	4
PRACTICAL													
1	RS304	Seminar	Core	0	3	0	50	50	100	00	100	0:3:0	3
2	RS305	Magnetic Resonance Imaging-Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
3	RS306	Hospital Practice & Care of Patient -Lab	Core	0	0	4	40	20	60	40	100	0:0:2	2
4	RS307	Hospital Posting	Core	0	0	14	40	20	60	40	100	0:0:7	7
Total				**09**	**06**	**20**	**290**	**170**	**460**	**240**	**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	RS301	Magnetic Resonance Imaging	Core	√	√	√			√	√	3,4
2	RS302	Hospital Practice & Care of Patient	Core	√	√	√	√		√	√	3,4
3	RS303	Orientation in Clinical Sciences-II Lab	Core	√	√	√	√		√	√	3,4
PRACTICAL											
1	RS304	Seminar	Core	√	√	√	√		√	√	3,4
2	RS305	Magnetic Resonance Imaging-Lab	Core	√	√	√	√		√	√	3,4
3	RS306	Hospital Practice & Care of Patient -Lab	Core	√	√	√			√	√	3,4
4	RS307	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: 2025-26							
Course Code	**RS301**	**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 Flow phenomena & MR Angiography along with MRI Safety.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**INTRODUCTION AND BASIC PRINCIPLE OF MRI**	1. **Introduction to MRI**: History of MRI, 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 & IMAGE FORMATION**	1. **MRI Hardware:** Introduction, Permanent magnets, Electromagnets, Superconducting magnets, Fringe fields, Shim coils, Gradient coils, Radio-frequency coils, pulse control units, Patient transportation system, and Operator interface. 2. **Encoding, Data collection & Image formation:** Introduction, Gradients, Slice selection, Frequency encoding, Phase encoding; Scan timing, Sampling, k-space, 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**,** and EPI. 2. **MRI parameters & Trade-offs:** Introduction, Signal to Noise Ratio (SNR) & how to increase SNR, Contrast to Noise Ratio (CNR), Spatial resolution, Trade-offs, Decision making, Volume imaging.	8	CO3
4	**MRI ARSE FACTS & CONTRAST AGENTS**	1. **MRI Artefacts:** 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. **2. 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, MR Angiography, MRS Blood Flow Imaging. 2. **Safety aspects:** 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 StewaRS 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	
RS301	MAGNETIC RESONANCE IMAGING	√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS302**	**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**	1. **Patient care and Assessment:** Taking history, assessing current physical status, 2. Skin temperature, color, consciousness, Breathing, Obtaining Vital signs, ElectronicPatient Monitoring.	8	CO1
2	**RESPONSIBILITIES OF RADIOGRAPHER & PATIENT TRANSFER TECHNIQUE**	1. **Responsibilities of the Imaging Technologist-** Medication administration, routes of administration, List of frequently used medications. 2. **Patient transfer technique &Restraint technique-** Preparation for transfer, wheelchair transfer, stretcher transfer, immobilization techniques.	8	CO2
3	**HANDLING THE EMERGENCIES & PATIENT CARE DURING INVESTIGATION**	1. **Handling the emergencies in Radiology**- Reaction to contrast media, Oxygen administration and suction, Respiratory emergencies, Cardiac emergencies, Trauma,Shock. 2. **Patient care during Investigation -** G.I. Tract, Biliary tract, Respiratory tract, Gynecology, Cardiovascular, Lymphatic system, C.N.S. etc.	8	CO3
4	**INFECTION CONTROL**	1. **Infection Control**: Microorganism- Bacteria, Viruses, Fungi, Prions, Protozo. 2. Cycle of Infection, Immunity, Infectious disease Transmission modes Isolationtechniques, Sterilization & sterile techniques.	8	CO4
5	**PATIENT EDUCATION & COMMUNICATION**	1. **Patient Education & Communication-** Patient communication problems. 2. Explanation of examinations, Radiation Safety / Protection Interacting withterminally 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/aRSicles/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.
RS302	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: 2025-26							
Course Code	**RS303**	**Title of the Course**	**ORIENTATION IN CLINICAL SCIENCES-II**	**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	**PATHOLOGY OF NERVOUS SYSTEM AND ENT**	1. Meningitis Cerebral Vascular Disorders, Encephalitis, Sinusitis, Polyps, DNS, Otitis 2. Media, Tonsillitis, CSF Rhino rhea.	8	CO1
2	**PATHOLOGY OF BRAIN**	1. Aneurysms, Arachnoids cysts, Alzheimer's, Parkinson's Shock, Hypertension, 2. Embolism, Hemorrhage.	8	CO2
3	**PATHOLOGY OFSPINE**	1. Hangman's fracture, Discitis, Spondylitis, IVDP, Scoliosis, Pott's, TB Spine, 2. Kyphosis.	8	CO3
4	**PATHOLOGY OFLUNGS, BLOOD AND INTESTINE**	1. Hematochezia, Anemia, Leukemia, Epilepsy, COPD, Asthma, Emphysema.	8	CO4
5	**PATHOLOGY OF LIVER AND OTHER CONDITIONS**	1. 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.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RS303	ORIENTATION IN CLINICAL SCIENCES	√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS304**	**Title of the Course**	**SEMINAR**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**0**	**3**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The objective is to expertise the student in presenting seminars for improvement of self confidence.						

Course Outcomes	
CO1	Student will be able to present seminar under concern topic in places like conferences, workshops, meets etc.
CO2	Student will have the knowledge on Power point presentation.
CO3	Student will have the presentation skill.
CO4	Student will have the knowledge on how to prepare a presentation for any event.
CO5	Student will be able to organize a Seminar, Webinar & Workshop.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**SEMINAR**	**1.** Each student will be assigned topics for presentations as seminars, will explore recent innovations in the depaRSment of Radiological Imaging Techniques for presenting topics during Seminar and shall be holding group discussions along with in the presence of faculty.	60	CO1-5

Reference Books:

1. Brandon AN, Hill DR. Selected list of books and journals for the small medical library.
2. Bulletin of the Medical Library Association. 1981 Apr;69(2):185.
3. Recent Research topics in Radio imaging (Diagnostic radiology)
4. RSNA (Journals from Radiological Society of North America)
5. AJR (American Journal of Radiology)/ (BJR) British Journal of Radiology
6. IJR (Indian journal of Radiology)/Internet journal of Radiology

e-Learning Source:

1.https://www.who.int/
2. https://main.mohfw.gov.in/

SEMINAR PRESENTATION ASSESSMENTN FORM

Name of Student:		**Session:**	
Enrolment Number:		**Date:**	
Name of Subject:	Seminar	**Subject code:**	RS304
Topics:			

Criteria	Sub-Criteria	Max. Marks	Marks Obtained
Introduction (Max marks-10)	Use appropriate background information	**04**	
	Has clear statement of purpose	**04**	
	Shows a logical sequence	**02**	
Factual Content (Max marks- 20)	Includes accurate information	**04**	
	Shows up-to-date content	**04**	
	Presents relevant content	**04**	
	Shows in-depth and sufficient details	**02**	
	Addresses all important issues	**02**	
	Is selective	**02**	
	Use of proper English Grammar in the text	**02**	
Presentation Quality (Max marks-06)	Has a good design of presentation (appropriate font, type, size, color, matter per slide etc.)	**04**	
	Has a clear verbal expression and eye contact with audience	**02**	
Response to questions (Max marks-10)	Answers question(s) correctly	**04**	
	Has the ability to think on the spot	**04**	
	Shows an ability to defend content of presentation	**02**	
Time Management (Max. mark-04)	Completes the presentation within allocated time	**04**	
	Total Marks	**50**	

Note: In case of Oral Presentation, each student will be assessed in a 20 minutes time (15 min for presentation & 5 min for discussion) out of 25 marks.

Comments/Suggestions:

Name and signature of Incharge **Head, Paramedical**

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EVALUATION OF SEMINAR

The evaluation for internal examination of 100 marks will be distributed:
Seminar Presentation=**50marks**.
Viva voce =**45 marks**
Attendance=**5 marks**

	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.
RS304	SEMINAR	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	**3,4**
		√	√	√			√	√	

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS305**	**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 Preparation of patient and different MRI procedures.
CO2	Students will have abundant Knowledge on MRI Protocols.
CO3	Students will have abundant Knowledge on Image processing techniques.
CO4	Students will have abundant Knowledge on MRI post procedure care of patient.
CO5	Students will have abundant Knowledge on Advance Techniques of MRI.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**PATIENT PREPARATION & MRIPROCEDURES**	1. Patient preparation, patient positioning, performing all non-contrast and contrast MRI procedures.	6	CO1
2	**MRI PROTOCOLS**	2. Planning of different scanning planes, parameters and their tradeoffs & patient monitoring during the procedures.	6	CO2
3	**IMAGE PROCESSING**	3. Various post-processing techniques and evaluation of image quality and clinical findings.	6	CO3
4	**PATIENT CARE**	4. Post-procedural care of the patient.	6	CO4
5	**ADVANCE MRI TECHNIQUES**	5. Advance Techniques of MRI.	6	CO5

Reference Books:

1. Mc Robbie 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.**
RS305	MAGNETIC RESONANCE IMAGING - LAB	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	**3,4**
		√	√	√			√	√	

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS306**	**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 Supervision of patient during procedures.
CO5	Student will have the knowledge on administration of drugs and contrast media and 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, and blood pressure.	8	CO1
2	**OXYGEN THERAPY**	2. Oxygen therapy and oxygen devices.	8	CO2
3	**ARSIFICIAL RESPIRATION AND RESUSCITATION**	3. ARSificial 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. 6. Aseptic and sterile procedures.	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 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/aRSicles/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.**
RS306	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: 2025-26							
Course Code	**RS307**	**Title of the Course**	**HOSPITAL POSTING**	**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 OFHANDLING PATIENTS**	1. Students shall be deputed to various labs of Radiology depaRSment wherein they shall undergo practical training of handling patients, collection and processing ofinvestigation (x ray, Special procedures, CT scan, MRI, and Ultrasound etc.) and equipment.	35	CO1
2	**IDENTIFICATIONS OF PATIENT**	2. Identification of patient's paRSiculars 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/aRSicles/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.
RS307	HOSPITAL POSTING	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

INTEGRAL UNIVERSITY, LUCKNOW

INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

DEPARSMENT OF PARAMEDICAL SCIENCES

BACHELOR OF MEDICAL RADIOLOGICAL IMAGING SCIENCES (BMRIS)

SYLLABUS

YEAR/ SEMESTER: III/VI

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

Program: BMRIS 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	RS308	Advance CT, MRI & USG	Core	3	1	0	40	20	60	40	100	3:1:0	4
2	RS309	Nuclear Medicine Technology & PET Scan	Core	3	1	0	40	20	60	40	100	3:1:0	4
3	RS310	Interventional Procedure & Emergency Drugs	Core	3	1	0	40	20	60	40	100	3:1:0	4
4	RS311	Research Methodology & Biostatistics	Core	3	1	0	40	20	60	40	100	2:1:0	4
PRACTICAL													
1	RS312	Advance CT, MRI & USG -Lab	Core	0	0	2	40	20	60	40	100	0:0:1	1
2	RS313	Nuclear Medicine Technology & PET Scan-Lab	Core	0	0	4	40	20	60	40	100	0:0:2	2
3	RS314	Hospital Posting	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	RS308	Advance CT, MRI & USG	Core	√	√	√	√		√	√	3,4
2	RS309	Nuclear Medicine Technology & PET Scan	Core	√	√	√	√		√	√	3,4
3	RS310	Interventional Procedure & Emergency Drugs	Core	√	√	√	√		√	√	3,4
4	RS311	Research Methodology & Biostatistics	Core	√	√	√	√		√	√	3,4
PRACTICAL											
1	RS312	Advance CT, MRI & USG -Lab	Core	√	√	√	√		√	√	3,4
2	RS313	Nuclear Medicine Technology & PET Scan Lab	Core	√	√	√	√		√	√	3,4
3	RS314	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: 2025-26							
Course Code	**RS308**	**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: Helical CT, MSCT & Image Processing Technique.
CO2	Students will have abundant Knowledge on MRI imaging techniques of various body parts.
CO3	Students will have Knowledge on Techniques of sonography for various body parts along with biopsy.
CO4	Students will have Knowledge on CT of various body parts.
CO5	Students will have abundant Knowledge on recent advancements in CT, MRI & USG.

Unit No.	Title of the Unit	Content Of Unit	Contact Hrs.	Mapped CO
1	**HELICAL CT, MSCT & IMAGE POST PROCESSING TECHNIQUES**	1. **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	8	CO1
2	**MRI IMAGING METHODS**	2. **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, reconstructions, 3D images, diffusion/perfusion scans, strength and limitations of MRI.	10	CO2
3	**TECHNIQUES OF SONOGRAPHY**	1. **Techniques of Sonography** – selection, Preparations, instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities, biopsy procedures, assurance to patients.	8	CO3
4	**CT SCAN TECHNIQUES**	1. 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.	8	CO4
5	**ADVANCEMENTS IN CT, MRI & USG**	1. Recent Advancements in CT, MRI & USG	6	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.
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.**
RS308	ADVANCE CT, MRI & USG	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS309**	**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 Nuclear Medicine Technology.						

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 & transpoRSation of radio-nuclides.
CO4	Students will have the Knowledge about Equipments of NMT
CO5	Students will have the Knowledge about Nuclear Medicine Techniques.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**INTRODUCTION TO NMT**	1. 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.	8	CO1
2	**PRODUCTION OF RADIO NUCLIDES**	1. Production of Radionuclides, Reactor produced radionuclides, Reactor principles; Accelerator produced radionuclides, Radionuclide generators.	8	CO2
3	**RADIO PHARMACY & HANDLING & TRANSPORS OFRADIO-NUCLIDES**	1. Radiopharmacy & Handling & Transport of Radio-nuclides Cold kits, Radiopharmacy used in nuclear medicine, Radiopharmaceuticals used in various procedures, Safe handling of radioactive materials, Procedures for handling spills.	8	CO3
4	**EQUIPMENTS OF NMT**	1. Equipments of NMT, Gamma camera, PET, SPECT (working principle).	8	CO4
	NUCLEAR MEDICINE TECHNIQUES	1. In vivo technique, Thyroid imaging, Imaging of bone, Respiratory system, Urinary system, GI system, Cardiovascular system.	8	CO5

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.
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RS309	NUCLEAR MEDICINE TECHNOLOGY & PET SCAN	√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS310**	**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 depaRSment with the help of radiological equipments.						

Course Outcomes	
CO1	At the end of the course, student will have knowledge on: Drugs, contrast media &equipments of interventional radiography.
CO2	At the end of the course, student will have knowledge on Equipments, procedure, technique and outcome of angiography.
CO3	At the end of the course, student will have knowledge on DSA.
CO4	At the end of the course, student will have knowledge on Sterile Techniques & Radiation Protection.
CO5	At the end of the course, student will have knowledge on Interventional Procedures of Cardiac, Vascular, and Nonvascular.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**INTRODUCTION TO INTERVENTIONAL RADIOLOGY**	1. 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 2. Types of contrast media, method of administration, contraindication, contrastreaction management, emergency crash caRS.	8	CO1
2	**ANGIOGRAPHIC EQUIPMENTSAND TECHNIQUES**	1. 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. 2. Types, Instrumentation	8	CO3
4	**STERILE TECHNIQUES &RADIATION PROTECTION**	1. Sterile Techniques & Radiation Protection 2. Laying up a sterile trolley, sterile techniques, radiation protection for staff andpatient, protective devices, monitors.	8	CO4
5	**INTERVENTIONAL PROCEDURES**	1. Interventional Procedures of 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.
RS310	INTERVENTIONAL PROCEDURE & EMERGENCY DRUGS	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS311**	**Title of the Course**	**RESEARCH METHODOLOGY & BIOSTATISTICS**	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	**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	At the end of the course, student will have knowledge on: Research methodology and identifying the problems.
CO2	At the end of the course, student will have knowledge on: Types of Data and collection of data.
CO3	At the end of the course, student will have knowledge on: Biostatistics & Variables of data.
CO4	At the end of the course, student will have knowledge on: Interpretation of data.
CO5	At the end of the course, student will have knowledge on: Construction of study and Statistical Analysis.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**RESEARCH METHODOLOGY & DESIGN**	1. **Research Methodology:** Introduction to research methods, identifying research problem. Ethical issues in research- Research design, Basic Concepts of Biostatistics.	8	CO1
2	**DATA TYPES**	1. **Types of Data-** Research tools and Data collection methods, sampling methods, developing a research proposal.	8	CO2
3	**BIOSTATISTICS**	1. **Biostatistics:** Need of biostatistics, what is biostatistics: beyond definition, understanding of data in biostatistics, how & where to get relevant data, Relation between data & variables. 2. **Type of variables:** defining data set, Collection of relevant data: sampling methods	8	CO3
4	**INTERPRETATION**	1. Normal Distribution, Standard deviation, Standard errors. Coefficient of Variation, t-test, Chi square test.	8	CO4
5	**CONSTRUCTIO FO STUDY & STATISTICAL ANALYSIS**	1. **Construction of study:** population, sample, normality and its beyond (not design of study, perhaps), Summarizing data on the pretext of underlined study. 2. 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=PLEIbY8S8u_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.
RS311	RESEARCH METHODOLOGY & BIOSTATICS	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS312**	**Title of the Course**	**ADVANCE CT, MRI & USG - 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 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: CT techniques.
CO2	At the end of the course, student will have knowledge on: MRI imaging methods.
CO3	At the end of the course, student will have knowledge on: post processing techniques of various procedures.
CO4	At the end of the course, student will have knowledge on: contrast enhanced techniques.
CO5	At the end of the course, student will have knowledge on: USG techniques.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**CT TECHNIQUES**	1. CT of head and neck – thorax – abdomen – pelvis – Musculo skeletal system	8	CO1
2	**MRI IMAGING METHODS**	1. MRI Scanners: Methods of MRI imaging methods – Head and Neck 2. Patient preparation-positioning of the patient –patient in MRI	8	CO2
3	**POST PROCESSING TECHNIQUES**	1. Special procedures- reconstructions- 3D images	8	CO3
4	**CONTRAST MEDIA & TECHNIQUES**	1. Patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display	8	CO4
5	**USG TECHNIQUES**	1. USG Techniques- TAS, TRUS, TVS & FNAC	8	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.poRSea.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.**
		Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
RS312	**ADVANCE CT, MRI & USG - LAB**	√	√	√			√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	**RS313**	**Title of the Course**	**NUCLEAR MEDICINE TECHNOLOGY & PET SCAN- 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 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 Nuclear Medicine Techniques.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**RADIOACTIVE ELEMENTS**	1. Study of Radioactivity and Radioactive Elements.	2	CO1
2	**RADIONUCLIDE PRODUCTION**	2. Study of Radionuclides and their production.	3	CO2
3	**PHARMACEUTICAL PRODUCTION & HANDLING**	3. Study of Radiopharmaceuticals, storage, handling and transport.	3	CO3
4	**NMT MODALITIES**	4. Demonstration of Nuclear Medicine Modalities.	6	CO4
5	**NM TECHNIQUES**	5. Demonstration of Nuclear Medicine and PET scan procedures.	6	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.
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/depaRSments-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.**
RS313	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: 2025-26							
Course Code	**RS314**	**Title of the Course**	**HOSPITAL POSTING**	**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**	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, Ultrasound etc.) and equipment.	30	CO1
2	**IDENTIFICATIONS OF PATIENT**	1. Identification of patient's particulars based on CR number, Lab Number and transfer of patients to different Radiology labs.	30	CO2
3	**RADIOLOGICAL TESTS**	1. Process of performing various tests in different Radiology labs.	30	CO3
4	**POSTING LOGBOOK**	1. 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 inhis/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

5.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/aRSicles/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.
RS314	HOSPITAL POSTING	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√			√	√	**3,4**