Sri Guru Ram Das University of Health Sciences, Amritsar
Course Structure for Bachelors in DMRIT (Code- DMRIT.1.3) Session 2024

Course code	Course Title	Course Type	L+T+P	Total Credits /Week	Weightage Theory/ Practical IA+UE
Semester-I					
DMRIT- ANT.201	Anatomy-I	Foundation	3+0+2	5	25+25=50T 50P
DMRIT-PHY.201	Physiology-I	Foundation	3+0+2	5	25+25=50T 50P
DMRIT.201	X-Ray Physics-I	Core	3+0+3	6	50+50=100T 100P
ECO.250	English/Communication skills	Elective	2+0+0	2	NC
		Total Credits	**11+0+7**	**18**	**400**
Semester-II					
DMRIT-ANT.202	Anatomy-I	Foundation	3+0+1	4	25+25=50T 50P
DMRIT-PHY.202	Physiology-II	Foundation	3+0+1	4	25+25=50T 50P
DMRIT.202	X-Ray Physics-II	Core	3+1+4	8	50+50=100T 50P
DMRIT-PAT.201	Pathology	Foundation	2+1+0	3	50+50=100T
COM.250	Computer applications	Elective	2+0+0	2	NC
		Total Credits	**13+2+6**	**21**	**450**
Semester-III					
DMRIT.301	Radiography	Core	3+1+0	4	50+50=100T
DMRIT.302	CT Physics-I	Core	3+1+4	8	50+50=100T 100P
DMRIT.303	Clinical Radiography- I	Core	3+1+4	8	50+50=100T 100P
HVE.350	Human Values & Ethics	Value added course	3+0+0	3	NC
		Total Credits	**12+3+8**	**23**	**500**
Semester-IV(new)					
DMRIT.304	Cross Sectional Anatomy	Foundation	2+0+3	5	20+50=70 10+20=30
DMRIT.305	Modern Radiological Imaging Equipment and Physics	Core	2+0+1	3	20+50=70 10+20=30
DMRIT.306	Interventional Radiology Techniques	Core	2+0+2	4	30+70=100T 30+70=100P
DMRIT.307	Patient Care in Radiology	Core	1+1+2	4	30+70=100T 30+70=100P
DMRIT.350	BMRIT Radiology Clinical Education-I	Core	0+0+4	4	NC
		Total Credits	**7+1+12**	**20**	**300+300=600**

SEMESTER IV

DMRIT.: Cross Sectional Anatomy

Cross sectional anatomy provides the students with Skills that are important to help the technologist in MRI and CT to identify the anatomy being imaged and to communicate effectively with the radiologist and physicians.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images.
CO2: Describe anatomical structural relationships.
CO3: Recognize normal anatomy and build a personal resource system for future study.
CO4: Locate and identify pertinent cerebral, upper thorax, mid-thorax, and abdominal anatomy.
CO5: On CT and MR images, identify anatomical structures of the body and of the head.
CO6: Distinguish between arterial and venous anatomy of the entire body's vascular system. **CO7:** Classify the various sections of anatomical regions and their associated parts.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	**100**
2	**--**	**6**	**5**	**--**	**--**	**50**	**50**	

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	**Introduction to Sectional Anatomy & Terminology-** Sectional planes, Anatomical relationships/terminology Anatomy of the upper thorax-Surface anatomy relationships, Bony structures and muscles, Blood vessels. Divisions of the mid-thorax, heart and great vessels-Lungs, heart and great vessels, Esophagus	**12**
II	**CT/MRI Images of the Thorax -** Normal and abnormal imaging **Anatomy of the Abdomen-** Major organs and their accessories, Abdominal blood vessels **CT/MR Images of Abdomen –** Normal and pathologic anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems **Reproductive Organs -** Normal and abnormal imaging	**12**
III	**CT/MR Images of the Male/Female Pelvis- Normal and pathologic** **Neuro Anatomy-**Scan planes **Brain –**Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves **Spine-** Vertebra and disc, Spinal cord and meninges **Neck-**Arterial/venous systems, Muscles, Glands and pharynx	**12**
Total		**36**

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	**Introduction to Sectional Anatomy & Terminology-** Sectional planes, Anatomical relationships/terminology Anatomy of the upper thorax-Surface anatomy relationships, Bony structures and muscles, Blood vessels. Divisions of the mid-thorax, heart and great vessels-Lungs, heart and great vessels, Esophagus	36
2.	**CT/MRI Images of the Thorax -** Normal and abnormal imaging **Anatomy of the Abdomen-** Major organs and their accessories, Abdominal blood vessels **CT/MR Images of Abdomen –** Normal and pathologic anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems **Reproductive Organs -** Normal and abnormal imaging	36
3.	**CT/MR Images of the Male/Female Pelvis- Normal and pathologic** **Neuro Anatomy-**Scan planes **Brain –**Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves **Spine-** Vertebra and disc, Spinal cord and meninges **Neck-**Arterial/venous systems, Muscles, Glands and pharynx	36
	Total	108

Evaluation System-Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two practical tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	***50***	***50%***	***50***
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	***50***	***50%***	***50***
	Total CIE marks			***30***

End Semester Evaluation (ESE)
There shall be practical examination for 100 marks in the subject.

Distribution of marks for ESE practical exams:

ESE		CIE		**Grand total**
Practical	Viva		Sub Total	
30	20	50	100	100

SUGGESTED LEARNING RESOURCES

S. No.	**Title of Book**	**Author**	**Publication**
1	Cross Sectional Anatomy CT & MR	G Bhavin Jhankaria	Jaypee Brothers Medical Publishers;
2	Step by step Cross-sectional Anatomy	D Karthikeyan	Jaypee brother medical publishers
3	Atlas of Cross Sectional Anatomy and Radiological Imaging	Dr David J. Jackowe	Anshan Ltd
4	Fundamentals of Sectional Anatomy: An Imaging Approach	Denise L. Lazo	Cengage Learning

Subject: Modern Radiological Imaging Equipment and Physics
Subject Code: DMRIT - 020
RATIONALE
Modern radiological Imaging Equipment and Physics provides the students knowledge about the modern x-ray equipment and working principle. Modern imaging techniques – including X-rays, ultrasound, CT scans and MRI – can show structures inside your body in great detail. Radiologic Physics

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**ESE**	**CIE**	**100**
2	**1**	**2**	**3**	**50**	**50**	**--**	**--**	

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	Modern x-ray tube. Digital Mammography and Tomosynthesis, Stitch radiography, Dual energy x-ray absorptionometry (DEXA) scan.	**9**
II	Computed radiography: its principle, physics & equipment. Digital Radiography: its principle, physics & equipment. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications. Digital Portable and mobile x-ray units.	**9**
III	Modern dental equipments. Cone beam dental CT.	**9**
IV	Picture archiving and communication system (PACS), RIS and HIS.	**9**
Total		**36**

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	Modern x-ray tube. Digital Mammography and Tomosynthesis, Stich radiography, Dual energy x-ray absorptionometry (DEXA) scan.	**9**
2.	Computed radiography: its principle, physics & equipment. Digital Radiography: its principle, physics & equipment. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications. Digital Portable and mobile x-ray units.	**9**
3.	Modern dental equipments. Cone beam dental CT.	**9**
4.	Picture archiving and communication system (PACS), RIS and HIS.	**9**
	Total	**36**

Evaluation System
Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	***25***	***25%***	**25**
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	***25***	***25%***	***25***
	Total CIE marks			***50***

SUGGESTED PRACTICALS/DEMONSTRATION

Unit	
1.	Modern x-ray tube. Digital Mammography and Tomosynthesis, Stich radiography, Dual energy x-ray absorptionometry (DEXA) scan.
2.	Computed radiography: its principle, physics & equipment. Digital Radiography: its principle, physics & equipment. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications. Digital Portable and mobile x-ray units.
3.	Modern dental equipments. Cone beam dental CT.
4.	Picture archiving and communication system (PACS), RIS and HIS.
	Total Marks (including optional questions)

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Textbook of Radiology: Physics	Amol Sasane, Hariqbal Singh, Roshan Lodha	Jaypee Brothers Medical Publishers
2	The Physics of Radiology and Imaging	THAYALAN K	Jaypee Brothers Medical Publishers
3	Christensen's Physics of Diagnostic Radiology	Thomas S. Curry, James E. Dowdey, Robert E. Murry	Lea & Febiger,U.S
4	Textbook Of Radiology for Residents and Technicians	BHARGAVA S. K (Author	CBS; publishers
5	Concise Text Book on Imaging Modalities & Recent Advances In Diagnostic Radiology	Lalit Agarwal, Dr. K.B. Gehlot	JBD Publications

Subject: Interventional Radiology Techniques

Subject Code: DMRIT -021

RATIONALE

Interventional radiology (IR) helps student MRIT to gain about the basics diagnostics and interventional procedures and to learn procedures in modalities like digital radiography CT and MRI and nuclear medicine and to increase the level of understandings and knowledge required to meet current radiologic procedures and to understand the physical principles of radiography and basic radiography positioning to perform the procedures. it a medical specialty that performs various minimally-invasive procedures using medical imaging guidance, such as x-ray fluoroscopy, computed tomography, magnetic resonance imaging, or ultrasound. IR performs both diagnostic and therapeutic procedures through very small incisions or body orifices

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Know the basic principle and physics of interventional equipment.
CO2: Know the management and positioning of patients while performing interventional radiological procedure.
CO3: Have knowledge about the indications, contraindications, contrast media, radiation dose, exposure timing and radiation safety measures for the different interventional radiological procedure.
CO4: Understand the patient preparation needed before any interventional radiological procedures.
CO5: Have knowledge about the post procedural care and safety.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	**200**
2	**1**	**4**	**4**	**50**	**50**	**50**	**50**	

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	Introduction to interventional procedures **DSA:** basic principles and types **Equipment:** Basics of angiographic equipment, single and biplane angiographic equipments, angiographic table, image intensifier, flat panel detectors, recording systems, pulse oximetry, cardiac resuscitation measure-ECG, pressure injector, catheters, needle and other tools, 3D rotational angiography, image processing, patient monitor, CO2 angiography	**6**
II	Interventional procedures: Catheter- classification, types and applications, Guide wire- classification, types and applications, Pressure Injector and Accessories, Percutaneous catheterization, Digital Subtraction Angiography, Catheterization Sites, Asepsis	**9**
III	Arteriography: Head and Neck Arteriography, Pulmonary Arteriography, Coronary Arteriography, Ascending Aortography, Trans Lumbar Aortography, Renal Arteriography, Trans Femoral Arteriography Venography: Peripheral Venography- Lower Limb, Upper Limb, Central Venography, Superior Venacavography, Inferior Venacavography, Pelvic Venography	**9**
IV	**Safety considerations in angiography room**; room design, protective devices, radiation monitoring	**6**
V	**Care and maintenance tests:** General care, functional test **Quality assurance program:** Acceptable limits of variation, corrective action	**6**
Total		**36**

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	Basics of angiographic equipments	18
2.	Catheter and guide wires	18
3.	Arteriography and venography procedures	18
4.	Safety considerations in angiography room	18
	Total	72

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	The practice of interventional radiology	Karim valji	
2	Interventional radiology: a survival guide	EBIR Kessel, David, Robertson, Iain	Elsevier Health Sciences
3	Handbook of Interventional Radiologic Procedures	Krishna kandarpa, lindsay machan, janettedurham	Lippincott Williams and Wilkins
4	Interventional Radiology: A Survival Guide	David Kessel , Iain Robertson	sevier Health Sciences
5	A Guide on Special Radiographic Investigations & Techniques	Lalit Agarwal	JBD Publications

Subject: Patient Care in Radiology
Subject Code: DMRIT - 022

RATIONALE

Patient management is based on team work, it is essential that the student should appreciate the technologist's role and that the importance of co-operation with wards and other departments. The students should be attached to wards or the accident and emergency department for a definite training period.

COURSE OUTCOMES

At the end of the course, students will be able to…

CO1: Understand the responsibility of the imaging technologist and other health care facility.
CO2: Understand the management and care of patient during different procedures and emergency situations.
CO3:Know about different patient transfer techniques and to restrain the uncooperative patients during radiological examination
CO4: Differentiate the types of consent forms
CO5: Know about infection control, infection source and isolation techniques
CO6: Describe sterilization techniques
CO7: Understand the radiation safety and protection

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**CIE**	**ESE**	**CIE**	**ESE**	**200**
1	**1**	**4**	**4**	**50**	**50**	**50**	**50**	

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and content	Hours

I	**Introduction to Patient Care:** Responsibilities of Medical Imaging Technologist, Obtaining Consents and history for different radiological examinations, Patient transfer and Restraining techniques, Obtaining vital signs, Ergonomics and body mechanism **Communication:** Patient education, Communication with the patient, Professional role and behavior	**2**
II	**Hospital procedure:** Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.	**2**
III	**Care of the patient:** FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients.	**3**
IV	**Nursing procedures in Radiology:** Injection- methods and their routes of administration, Clothing of patient, Administering rectal enema. **First aid:** Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons.	**3**
V	**Infection:** Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc. **Principles of asepsis:** Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filamented swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department (for study by radio imaging students only)	**3**
VI	**Patient care in following investigations:** GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control **Departmental procedures:** Department staffing and organizations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department; appointments; organisations; minimizing waiting time; out-patient and follow-up clinics; stock taking and stock keeping.	**2**
VII	**Drugs in the department and Storage:** classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti-depressive, anti- hypertensive etc. crash cart. **Medical ethics and records:** Medico legal implication of MLC cases, Importance of consent, Consent in detail, Precaution while dealing with female patient, Medical records	**3**
	Total	**18**

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	Introduction to Patient Care and Communication	10
2.	Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out- patient and follow-up clinics; stock-taking and stock keeping.	11
3.	Care of the patient	10
4.	Nursing procedures in Radiology and first aid	11
5.	Infection and Principles of asepsis	10
6.	Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control.	10
7.	Drugs in the department and Storage and medical ethics and records	10
	Total	72

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Patient care in radiography	Ruth Ann Ehrlich, Dawn M Coakes	Mosby
2	Concise Textbook on Hospital Management & Patient Care in Diagnostic Radiology	N.K.Kardam,, Lalit Agarwal	JBD Publications
3	Patient care in radiography: with an introduction to medical imaging	Ruth Ann Ehrlich and Joan A. daly	St. Louis, Mo. : Mosby Elsevier
4	Introduction To Radiologic And Imaging Sciences And Patient Care	Adler A M	Elsevier
5	Concise Text Book on Hospital Management & Patient Care In Diagnostic Radiology	Lalit Agarwal , Dr. N.K. Kardam	JBD Publications