

GURU KASHI UNIVERSITY



Diploma in Medical Radiology and Imaging Technology (DMRIT)

Session: 2026-27
Faculty of Allied & Healthcare

Graduate Attributes of the Program:

Diploma in Medical Radiology and Imaging Technology (DMRIT) program is designed to produce competent, ethical, and compassionate Medical Radiology and Imaging Assistants who possess a sound foundation in radiographic sciences, patient care, radiation safety, and professional practice. Graduates are equipped with the knowledge and technical skills required to perform routine diagnostic radiographic procedures, operate conventional X-ray, CR/DR, mobile X-ray, C-arm, fluoroscopy, and dental radiography equipment under the supervision of qualified radiographers or radiologists. They demonstrate competency in patient positioning, image acquisition, quality assurance, infection control, biomedical waste management, and radiation protection while adhering to the ALARA principle and professional ethics.

The objectives of the program are to:

1. Develop competent Medical Radiology and Imaging Assistants capable of performing routine diagnostic radiographic procedures under appropriate supervision.
2. Provide a strong foundation in human anatomy, physiology, radiation physics, radiographic equipment, and imaging science.
3. Develop knowledge and practical skills in conventional radiographic positioning, exposure techniques, and image acquisition.
4. Train students in the operation of fixed and mobile X-ray units, Computed Radiography (CR), Digital Radiography (DR), C-arm, dental radiography, and fluoroscopy systems.
5. Promote the principles of radiation protection, radiation safety, quality assurance, and quality control in accordance with national and international guidelines.
6. Prepare students to provide safe, ethical, compassionate, and patient-centered care while maintaining professionalism and effective communication.
7. Develop competency in patient preparation, positioning, monitoring, and assistance during diagnostic radiological procedures.
8. Equip students with the knowledge and skills for routine maintenance of radiographic equipment, imaging accessories, and quality control practices.
9. Train students in biomedical waste management, infection prevention, and maintenance of radiology records, inventories, and emergency preparedness.
10. Foster critical thinking, problem-solving, teamwork, and professional responsibility in clinical radiology practice.

11. Prepare graduates for employment in hospitals, diagnostic centers, trauma centers, primary healthcare centers, and rural healthcare facilities.
12. Encourage lifelong learning, continuing professional development, and progression to higher qualifications in Medical Radiology and Imaging Technology.

Element of the Descriptor	Program learning outcomes relating to Diploma Degree
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Demonstrate knowledge of human anatomy, physiology, radiation physics, radiographic equipment, image processing, radiation protection, and patient care.
	Explain the principles and applications of conventional radiographic procedures, CR/DR systems, fluoroscopy, mobile X-ray, and C-arm imaging.
	Understand radiographic positioning techniques and exposure parameters for routine diagnostic imaging.
	Describe quality assurance, quality control, biomedical waste management, and infection control practices.
	Recognize the roles and responsibilities of a Medical Radiology and Imaging Assistant within the healthcare system.
General, technical and professional skills required to perform and accomplish tasks	Perform routine radiographic examinations under appropriate supervision using standard operating procedures.
	Position patients accurately while ensuring comfort, dignity, and radiation safety.
	Operate and assist in the use of fixed X-ray, mobile X-ray, CR/DR, fluoroscopy, C-arm, and dental radiography equipment.
	Apply radiation protection measures, equipment handling, and preventive maintenance practices.
	Maintain patient records, imaging documentation, inventory, and departmental workflow professionally.
Application of knowledge and skills	Apply theoretical knowledge to perform routine diagnostic radiographic procedures safely and effectively.
	Select appropriate exposure factors and positioning techniques to obtain quality diagnostic images.

	Assist radiologists and senior technologists during routine radiological procedures. Implement quality assurance, infection prevention, and biomedical waste management protocols in clinical practice. Respond appropriately to routine technical problems and patient care situations encountered during radiographic procedures.
Generic learning outcomes	Demonstrate effective verbal and written communication with patients and healthcare professionals. Work collaboratively as an effective member of the multidisciplinary healthcare team. Apply critical thinking and problem-solving skills in routine radiographic practice. Demonstrate lifelong learning through continuing education and professional development.
Constitutional, humanistic, ethical, and moral values	Practice with honesty, integrity, professionalism, and accountability. Respect patient rights, privacy, confidentiality, and informed consent. Provide compassionate, patient-centered, and culturally sensitive care. Follow ethical principles, legal regulations, and radiation safety standards.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Demonstrate an entrepreneurial mindset by understanding healthcare operations, resource management, and opportunities for career progression and higher education. Demonstrate competency for employment in hospitals, diagnostic centres, trauma centres, and primary healthcare facilities. Apply quality improvement, equipment care, and departmental management principles to enhance healthcare services. Maintain professional discipline, punctuality, teamwork, and workplace ethics. Develop leadership, adaptability, and decision-making skills within supervised radiology practice.
Credit requirements	Total Programme Hours: 3240 hours - Theory & Practical Classes: 2160 hours - Internship: 1080 hours

	Foundation Courses: 12 Core Courses: 58 Auxiliary Courses: 10 Internship: 20 Total Credits: 100
Entry requirements	Admission is based on 10+2 merit, subject to reservation policies of the Central/State Government.
	Must have studied Physics, Chemistry, and Biology (PCB).
	Minimum age 17 years on or before 31 December of the admission year.

SEMESTER: 1st											
S.No.	Course Code	Course Title	L	T	P	No. of Credit	Internal Examination		External Examination		Total Marks
							Theory	Practical	Theory	Practical	
1.	DMRI101	Human Anatomy	3	0	0	3	30	-	70	-	100
2.	DMRI102	Physiology	3	0	0	3	30	-	70	-	100
3.	DMRI103	Basic of Radiation Physics	5	1	0	6	30	-	70	-	100
4.	DMRI104	Introduction to Healthcare & Medical Terminology and Record Keeping*	2	0	0	2	15	-	35	-	50
5.	DMRI105	English and Communication Skills*	2	0	0	2	15	-	35	-	50
6.	DMRI106	Clinical Education I	0	0	20	4	-	15	-	35	50
	Grand Total		15	1	20	20	120	15	280	35	450

* The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

SEMESTER: 2nd											
S.No.	Course Code	Course Title	L	T	P	No. of Credits	Internal Examination		External Examination		Total Marks
							Theory	Practical	Theory	Practical	
1.	DMRI201	Basic of Biochemistry	3	0	0	3	30	-	70	-	100
2.	DMRI202	Conventional Radiography Equipment	4	0	2	5	30	-	70	-	100
3.	DMRI203	Clinical Radiography Positioning I	4	0	6	7	30	15	70	35	150
4.	DMRI204	Basic Computers and Information Science*	2	0	0	2	15	-	35	-	50
5.	DMRI205	Clinical Education II	0	0	15	3	-	15	-	35	50
	Grand Total		13	0	23	20	105	30	245	70	450-

* The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

SEMESTER: 3rd											
S.No.	Course Code	Course Title	L	T	P	No. of Credits	Internal Examination		External Examination		Total Marks
							Theory	Practical	Theory	Practical	
1.	DMRI301	Basics of Microbiology	3	0	0	3	30	-	70	-	100
2.	DMRI302	Clinical Radiography Positioning II	4	1	6	8	30	15	70	35	150
3.	DMRI303	Xray Image Processing	3	0	2	4	30	15	70	35	150
4.	DMRI304	Principle of Management*	2	0	0	2	15	-	35	-	50
5.	DMRI305	Clinical Education III	0	0	15	3	-	15	-	35	50
	Grand Total		12	1	23	20	105	45	245	105	500

* The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

SEMESTER: 4th											
S.No.	Course Code	Course Title	L	T	P	No. of Credits	Internal Examination		External Examination		Total Marks
							Theory	Practical	Theory	Practical	
1.	DMRI401	Hospital Practice and patient Care	2	0	2	3	15	15	35	35	100
2.	DMRI402	Radiological Procedures	3	0	4	5	30	15	70	35	150
3.	DMRI403	Radiation Safety and Quality Assurance in Radiography	3	0	2	4	30	15	70	35	150
4.	DMRI404	Introduction to USG, CT and MRI	3	0	0	3	30	-	70	-	100
5.	DMRI405	Medical Law and Ethics & Professionalism and Values*	2	0	0	2	15	-	35	-	50
6.	DMRI406	Clinical Education IV	0	0	15	3	-	15	-	35	50
	Grand Total		13	0	23	20	120		280	140	600

* The Institute level examination will be held before the commencement of the University examinations. A Pass in the course with a minimum of 25 marks (50% of the total 50 marks) is compulsory in order to be eligible for the award of Diploma. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

SEMESTER: 5th											
S.No.	Course Code	Course Title	L	T	P	No. of Credits	Internal Examination		External Examination		Total Marks
							Theory	Practical	Theory	Practical	
1.	DMRI501	Internship	0	0	0	20	-	-	-	-	-
	Grand Total		0	0	0	20	-	-	-	-	-

1ST SEMESTER

Course Title: Human Anatomy	L	T	P	Cr.
Course Code: DMRI101	3	0	0	3

Total Hours 39 hrs**Course Outcomes:** At the end of the course students will be able to...

1. Describe the general anatomy of human body.
2. Explain normal disposition of various structures and organs in the body and its clinical correlation.
3. Describe the microscopic structure of various tissues.
4. Determine the topography of various structures on the surface of the body.
5. Identify and locate structures of the body.
6. Identify organs and tissues under microscope.
7. Point out various features of appearance of normal body in skiagrams.

COURSE CONTENTS**UNIT-I****05 Hours****Introduction: Human Body as a Whole**

Definition of anatomy and its subdivisions, terms of location, positions and planes, cell and its organelles, epithelium: definition, classification, describe with examples, functions, glands: classification, describe serous and mucous glands with examples, basic tissues: classification with examples.

UNIT-II**07 Hours****Locomotion and Support**

Cartilage: types, examples and histology. Bone: classification, examples and histology. Parts of long bone, names of all bones, vertebral column and intervertebral disc. Fontanel of fetal skull. Joints: classification of joints with examples, typical synovial joint in detail. Muscular system: classification of muscular tissue and histology.

Important muscles of the body: Sternocleidomastoid, trapezius, muscles of tongue, deltoid, biceps brachii, intercostal muscles, thoracic diaphragm, rectus abdominis, external oblique, internal oblique, transversus abdominis,

pelvic diaphragm, gluteus maximus, gluteus medius, gluteus minimus, quadriceps femoris and soleus.

UNIT-III

07 Hours

Cardiovascular System

Heart: size, location, chambers, exterior and interior, blood supply of heart, pericardium, systemic and pulmonary circulation, branches of aorta: common carotid artery, subclavian artery, axillary artery, brachial artery, radial artery, superficial palmar arch, femoral artery, popliteal artery and dorsalis pedis artery. Peripheral pulse, inferior vena cava, portal vein, portosystemic anastomosis, great saphenous vein, median cubital vein, dural venous sinuses. Lymphatic system: cisterna chyli and thoracic duct, lymphatic tissues and its histology, regional lymph nodes: cervical, axillary and inguinal lymph nodes.

Respiratory System

Parts of respiratory system: nose, nasal cavity, paranasal air sinuses, larynx, trachea, lungs, pleura and bronchopulmonary segments. Histology of trachea and lungs.

UNIT-IV

07 Hours

Gastro-Intestinal System Theory

Parts of GIT: oral cavity (lip, cheek, tongue, salivary glands, palate, dentition), pharynx (Waldeyer's ring), oesophagus, stomach, small and large intestine and appendix, liver, gall bladder, pancreas and spleen. Histology of oesophagus, stomach, small and large intestine, liver, gall bladder and pancreas.

Peritoneum

Description of reflections, folds and pouches in brief.

UNIT-V

07 Hours

Urinary System

Kidney, ureter, urinary bladder, male and female urethra. Histology of kidney, ureter and urinary bladder.

Reproductive System

Parts of male reproductive system: testis, vas deferens, epididymis and prostate. Parts of female reproductive system: uterus, fallopian tubes, ovary and mammary gland. Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary.

Endocrine Glands

Names of all endocrine glands. Describe in detail the pituitary gland, thyroid gland, parathyroid gland and suprarenal gland. Histology of pituitary, thyroid, parathyroid and suprarenal glands.

UNIT-VI

06 Hours

Nervous System

Neuron, classification of nervous system, cerebrum, cerebellum, brain stem, spinal cord and spinal nerve, meninges, ventricles and cerebrospinal fluid, blood supply of the brain, cranial nerves in brief, nerve plexus (brachial and lumbar).

Sensory Organs

Skin and its appendages. Eye: parts of eyeball and lacrimal apparatus, extraocular muscles, histology of cornea and retina. Ear: parts of ear, external, middle and inner ear and their contents.

Embryology

Spermatogenesis and oogenesis, ovulation, fertilization and placenta.

SUGGESTED PRACTICALS/DEMONSTRATION (6 Hours)

- Demonstration of Histology of types of epithelium, Histology of serous, mucous and mixed salivary gland, Surface marking of the body region wise.
- Demonstration of Histology of hyaline, elastic and fibrocartilage, Demonstration of all bones showing parts, radiographs of normal bones and joints, Histology of compact bone (TS and LS), Demonstration of all muscles of the body, Histology of skeletal, smooth and cardiac muscle.
- Demonstration of heart, pericardium and vessels of the body, Histology of large artery, medium sized artery and large vein, Histology of lymph

node, spleen, tonsil and thymus, Normal chest radiograph showing heart shadows, Normal angiograms.

- Demonstration of parts of respiratory system, Normal radiographs of chest, Histology of lung and trachea.
- Demonstration of parts of GIT, liver, gall bladder, pancreas and spleen, Histology of tongue, salivary glands, oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas and spleen, Radiographs of abdomen plain and contrast.
- Demonstrations of reflections, folds and pouches.
- Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder, Radiographs of abdomen – IVP, retrograde cystogram. Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary, Radiographs of pelvis – Hysterosalpingogram. Demonstration of the glands, Histology of pituitary, thyroid, parathyroid, suprarenal glands.
- Demonstration of Histology of peripheral nerve and optic nerve, Demonstration of major nerves in the body,
- Demonstration of cranial cavity and parts of brain, Histology of cerebrum, cerebellum, spinal cord
- Demonstration of Histology of thin and thick skin, Demonstration of histology of cornea and retina.

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Human Anatomy, Vol.1, 2 & 3, 5th edition, 2010, B.D. Chaurasia CBS publishers & distributors Pvt. Ltd.*
- *Physiology & Anatomy with Practical Considerations Ester. M. Grishcimer J. P. Lippincott. Philadelphia*
- *Manipal Manual of Anatomy, 2nd edition, 2012 Sampath Madhyastha CBS publishers & distributors Pvt. Ltd*
- *Text Book of General Anatomy, 2nd edition, 2013 Shobha Rawlani and Shivalal Rawlani Jaypee brothers*
- *Langman's Medical Embryology, 11th edition, 2009 T.W Sadler Wolters Kluwer.*

Course Title: Physiology	L	T	P	Cr.
Course Code: DMRI102	3	0	0	3

Total Hours 39 hrs

Course Outcomes: At the end of the course students will be able to...

1. Explain the normal functioning of organs and systems.
2. Understand the interrelationships and interactions among various organs and systems for maintaining homeostasis.
3. Assess the relative contribution of each organ systems toward the maintenance of constant internal environment
4. Differentiate between normal and abnormal functioning of organs and systems,
5. Understand physiological basis of pathogenesis and treatment of diseases and disorders.
6. Apply the physiological basis in the field of allied health care

COURSE CONTENTS

UNIT-I

07 Hours

General physiology

Introduction to Physiology, Concept of Homeostasis, cell – Morphology – Functions of organelles and Cell membrane, Transport mechanisms, Body fluid compartments.

Muscle nerve physiology

Neurons: Morphology, Action Potential, Neuroglia: Types & functions, Muscles: Types, structure of sarcomere. Neuromuscular junction, sliding filament mechanism of contraction.

Blood

Composition, properties, functions. Plasma proteins: Concentrations and functions, RBC: Morphology, functions, count, physiological variations and life span Erythropoiesis – stages, essential factors, regulation of Erythropoiesis, Haemoglobin: Functions, concentration, physiological variations. Fate of Haemoglobin – Jaundice, types, Color index, MCH, MCV, MCHC, PCV – normal values, WBC: Morphology, functions of all types including T & B lymphocytes, total and differential counts, physiological variations, Platelets: Morphology, count, functions, thrombocytopenia & bleeding time, Blood groups: Basis of blood grouping. Landsteiner's laws, ABO system, determination of blood groups, blood transfusion, complications of

incompatible blood transfusion, Rh group, erythroblastosis foetalis, prevention and treatment, Blood bank.

Haemostasis: Mechanisms. Clotting mechanism: factors, intrinsic and extrinsic pathways.

Disorders of clotting – haemophilia, vitamin K deficiency. Anticoagulants – mechanism of action and their uses, Anaemia: Classification – Morphological and Etiological, Blood volume: normal values.

UNIT-II

05 Hours

Cardiovascular system

Organization of cardiovascular system, greater and lesser circulation, Physiological anatomy of the heart, nerve supply, Junctional tissues of heart (pacemaker), Cardiac cycle: Mechanical events, Heart sounds, causes, characteristics and significance, Normal ECG, clinical significance of ECG, Heart rate – Physiological variations, Cardiac output: Definitions, normal values, physiological variations, Arterial blood pressure: Definitions, normal values, physiological variations, factors maintaining blood pressure. Role of baroreceptors in regulation of blood pressure.

UNIT-III

07 Hours

Respiratory system

Respiratory and non-respiratory function of respiratory system. Physiological anatomy of respiratory system Functions of respiratory tract. Respiratory membrane. Respiratory muscles.

Surfactant: functions, respiratory distress syndrome.

Definitions of terms used in respiratory physiology: Eupnea, Hyperpnoea, Tachypnea, Apnea, Dyspnea.

Mechanics of breathing – intrapulmonary and Intrapleural pressure changes during a respiratory cycle.

Spirometry – Lung volumes and capacities. Vital capacity.

Oxygen transport: Role of haemoglobin, factors affecting, oxygen carrying capacity. Carbon dioxide transport: forms, chloride shift (Hamburger's phenomenon).

Respiratory centers. Role of chemo receptors in regulation of respiration. Pulmonary ventilation and alveolar ventilation. Partial pressure of gases, Calculation of partial pressure of gasses in mixture. Arterial and venous blood gas concentrations and contents.

Hypoxia: Types and effects Cyanosis, Asphyxia, Periodic Breathing, Acclimatization.

Hyperbaric O₂ therapy, Artificial respiration and Ventilators.

UNIT-IV

03 Hours

Excretory system

Functions of kidneys. Nephrons – Juxta glomerular apparatus – functions, Steps in Urine formation – Ultrafiltration, Tubular Reabsorption, Tubular Secretion, GFR.

Definition, normal values, factors affecting GFR, measurement of GFR, Renal threshold for glucose, tubular load for glucose, Role of aldosterone and ADH in urine formation, Micturition, Innervation of bladder. Diuresis, Renal functions tests – Based on analysis of urine and analysis of blood, Skin: Functions of skin. Sweat glands.

UNIT-V

04 Hours

Digestive system

Introduction, structure of alimentary canal, Saliva: Composition, functions, Stomach: Functions. Gastric Juice: composition, functions, Pancreatic Juice: Composition and functions, Liver: Functions, Bile: composition, functions, Gall bladder: functions, Succus entericus: Composition, functions. Functions of large intestine, Movements of small intestines, Deglutition.

UNIT-VI

07 Hours

Endocrine system

Major endocrine glands- Hormone: Definition, Anterior pituitary: hormones and their functions, disorders – Gigantism, acromegaly, dwarfism, Posterior pituitary:

Hormones – diabetes insipidus, Thyroid: Hormones, normal values, functions, role of TSH. Disorders: simple goitre, myxoedema, cretinism, Grave's disease, Adrenal cortex: hormones, functions of cortisol and aldosterone. Addison's disease, Cushing's syndrome, Adrenal medulla: actions of adrenaline and noradrenaline, Endocrine pancreas: Insulin & glucagon, functions, Regulation of blood glucose level, diabetes mellitus, Parathyroid: Functions of PTH.

Nervous system

Synapse: Types, Transmission, Sensory receptors: Definition, Classification Organization of spinal cord, Functions of Dorsal column and Spinothalamic tract,

Functions of Corticospinal tract, Reflex Action: Definition, reflex arc, Functions of Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Cerebral cortex:

Lobes & functions. EEG – Definition and uses, Autonomic nervous system: Organization & functions, Cerebrospinal fluid: Composition and function.

UNIT-VII

06 Hours

Special senses

Vision: Physiological anatomy of eye ball, rods & cones, Refractive errors: Myopia, hypermetropia, presbyopia & astigmatism, Audition: Functions of outer, middle & inner ear, cochlea, Deafness – types, Taste: Taste buds, primary taste sensation, Smell: Receptors, modalities of smell

Reproductive system

Male reproductive system: functions of testes, puberty, spermatogenesis functions of testosterone, semen, Female reproductive system: Ovarian hormones functions – Menstrual cycle, Hormonal basis of changes in menstrual cycle, Family Planning.

SUGGESTED PRACTICALS/DEMONSTRATION (6 Hours)

- Study of Microscope and its uses
- Collection of blood and study of haemocytometer
- Haemoglobinometry
- Determination of RBC count

- Determination of WBC count
- Determination of blood groups
- Determination of bleeding time
- Determination of clotting time
- Recording of Arterial Blood Pressure,
- Clinical examination of Radial pulse
- Recording of spirogram and determination of vital capacity
- Artificial respiration, CPR
- Demonstration of ECG recording

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Foundation of Anatomy and Physiology*, Ross Wilson, Churchill Livingstone.
- *Physiology & Anatomy with Practical Considerations*, Ester. M. Grishcimer, J.P. Lippincott. Philadelphia
- *Text Book of Physiology*, A. P. Krishna, Suman Publication
- *Text Book of Physiology*, A.K. Jain, Avichal Publishing Company

Course Title: Basics of Radiation Physics	L	T	P	Cr.
Course Code: DMRI103	5	1	0	6

Total Hours 36 hrs

Course Outcomes: At the end of the course students will be able to...

1. Describe general physics related to imaging
2. Differentiate between within general radiation
3. Identify construction of radiology equipment's
4. Interpret quality of control of radiology equipment's
5. Differentiate between x-ray equipment's and other radiology related equipment's
6. Describe production of x-rays
7. Describe circuit system of radiology equipment's

COURSE CONTENTS

UNIT-I

05 Hours

Basic concepts: Units and measurements-Force, work, power and energy-Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization-excitation-Binding energy-electron volt Electromagnetic radiation-Quantum nature of radiation-mass energy equivalence-Fluorescence-electromagnetic spectrum.

UNIT-II

06 Hours

Electricity and magnetism: Electric charges, Coulomb's law-Unit of charge-Electric potential, unit of potential-Electric induction, capacitance and Capacitors, series and parallel connection-electric current, unit, resistance, ohm's law, electric power, Joule's law. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS values and current and voltage, circuit containing LR, CR and LCR-Power factor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current.

Electromagnetic waves: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.

UNIT-III**05 Hours****Electronics**

Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers.

Semiconductor diodes: p-n junction-properties forward and reverse bias, characteristics of p-n junction Rectifiers-Half-wave and full wave, ripple factor, Efficiency of HW and FW rectifiers. Filter circuits; Zener diode, regulated power supply.

Transistors-Symbols, Transistor connections and characteristics, Transistor as an amplifier, load line analysis, operating point, types of amplifiers-voltage and power amplifiers. Feedback-negative feedback in amplifiers.

UNIT-IV**05 Hours**

Discovery of x-rays-X-ray production and properties: Bremsstrahlung Radiations-Characteristics X-Rays, factors affecting X-ray emission spectra, X-ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets.

UNIT-V**04 Hours****Heat**

Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion, Newton's law of cooling, Heat radiation, perfect black body, Stefan law, application in Diagnostic Radiology (Heat dissipation in both stationary and rotating X-ray tubes).

UNIT-VI**05 Hours**

Interaction of ionizing radiation with matter: Types of interactions of X- and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation.

Interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, half value layer and linear attenuation coefficient-coherent scattering-photonuclear disintegration-Particle interactions. Interactions of X rays and Gamma rays in the body; fat soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance.

UNIT-VII

06 Hours

Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.

Radiation intensity and exposure, photon flux and energy flux density. f. LET, range of energy relationship for alpha, beta particles with X-Rays.

Physical quantity, its unit and measurement: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVp, mA, mAS, Heat unit).

SUGGESTED PRACTICALS/DEMONSTRATION (15 Hours)

- Units and Measurements
 - Define force, work, power and energy.
 - Write SI units of force, work, power and temperature.
 - Differentiate heat and temperature.
 - Calculate work done when force = 10 N and displacement = 5 m.
- Atomic Structure
 - Define atom, nucleus and isotope.
 - Explain ionization and excitation.
 - Define binding energy.
 - Explain electromagnetic radiation.
- Quantum Physics
 - Define electron volt.
 - State mass-energy equivalence.
 - Explain quantum nature of radiation.
- Electricity Basics
 - State Coulomb's law.
 - Define electric potential.
 - Explain capacitance.
 - Define resistance.
- Circuits
 - State Ohm's law.

- Define EMF.
 - Differentiate series and parallel circuits.
- Alternating Current
 - Define RMS value.
 - Explain power factor.
 - Describe LCR circuit.
- Electromagnetic Waves
 - Define electromagnetic waves.
 - Explain energy density.
 - List electromagnetic spectrum.
- Semiconductors
 - Define intrinsic semiconductor.
 - Differentiate n-type and p-type semiconductors.
 - Define majority carriers.
- Diodes
 - Define p-n junction.
 - Explain forward and reverse bias.
 - What is rectification?
- Transistors
 - Define transistor.
 - Explain amplification.
 - Define feedback in amplifiers.
- X-ray Production
 - Define Bremsstrahlung radiation.
 - Define characteristic radiation.
 - Explain Half Value Layer (HVL).
- Heat
 - Define heat capacity.
 - Explain modes of heat transfer.
 - Define thermal conductivity.
- Radiation Interaction
 - Define photoelectric effect.
 - Explain Compton scattering.
 - Define pair production.
- Attenuation
 - Define attenuation.
 - Explain Half Value Thickness (HVT) and Tenth Value Thickness (TVT).
 - Define linear attenuation coefficient.
- Radiation Quantities
 - Define photon flux.
 - Explain Linear Energy Transfer (LET).
 - Write units of kVp, mA, mAs.

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Basic radiological physics, K. Thayalan, Jaypee Brothers Medical Publishers (P) Limited, 2003*
- *Christensen's physics of diagnostic radiology, Curry and Dowdey, Wolters Kluwer*
- *X-Ray Equipment for Student, D.N. And M.O. Chesney, Blackwell Science Ltd*
- *A Textbook of Radiation Physics for Radiologic Technology, Surendra Maharjan, Suraj Sah, Samiksha Publications*

Course Title: Introduction to Healthcare and Medical Terminology and Record Keeping*	L	T	P	Cr.
Course Code: DMRI104	2	0	0	2

Total Hours 30 hrs

Course Outcomes: At the end of the course students will be able to...

1. Explain the concept of health, its determinants, health indicators in India, the health team concept, National Health Policy, national health programmes, and family welfare programmes.
2. Describe basic nursing principles, interpersonal relationships, bandaging techniques, patient positioning, bed making, comfort measures, and methods of safe patient handling and transportation.
3. Explain bedside management procedures, including bedpan usage, observation of stools, urine and sputum, catheter care, enema procedures, feeding, tube feeding, intravenous drips, and transfusion.
4. Demonstrate an understanding of vital signs monitoring and recording, aseptic techniques, sterilization, disinfection, observation of surgical dressings, and basic first aid.
5. Explain the origin, derivation, and structure of medical terminology, including word roots, prefixes, suffixes, combining forms, pluralization rules, abbreviations, and symbols.
6. Construct and interpret medical terms related to the integumentary, musculoskeletal, respiratory, cardiovascular, nervous, and endocrine systems, including diagnostic, surgical, and procedural terminology relevant to medical radiology and imaging technology.
7. Interpret medical orders, diagnostic reports, and clinical documentation, and explain the principles of medical record keeping, data entry, and electronic health record management while maintaining accuracy and confidentiality.

COURSE CONTENTS

UNIT-I

15 Hours

Introduction to Health:

- Definition of Health, Determinants of Health, Health indicators of India, Health team concept
- National Health Policy National Health Programs (Brief objectives and scope)
- Family welfare programs in India

Introduction to Nursing:

- Nursing and Nursing principles, Interpersonal relationships, Bandaging basic turns, Bandaging extremities, Triangular bandages and their applications
- Nursing position, bed making, prone, lateral, dorsal, dorsal recumbent, Fowler's position, comfort measures, Aids, rest and sleep
- Lifting and transporting patients, transferring patients to wheel chair, transferring from bed to stretcher

Bedside Management:

- Proper usage of bedpan, Observation of stools, urine, sputum. Understand the use and care of catheters. Enema procedures

Method of giving nourishment:

- Feeding, tube feeding, drips, transfusion Monitoring and recording of vitals
- Simple aseptic techniques, sterilization and disinfection
- Observation of surgical dressings
- Concepts of First Aid

UNIT-II**15 Hours****Medical Terminologies and Record Keeping**

- Derivation of medical terms.
- Define word roots, prefixes and suffixes.
- Conventions for combined morphemes and the formation of plurals.
- Basic medical terms.
- Form medical terms utilizing roots, suffixes, prefixes and combining roots.
- Interpret basic medical abbreviations/symbols.
- Utilize diagnostic, surgical and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system and endocrine system.
- Interpret medical orders/reports.
- Data entry and management on electronic health record system.

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Principles and Practice of Nursing Management and Administration, Jogindra Vati, Jaypee Brothers Ltd*
- *Textbook of Preventive and Social Medicine, K Park, Banarsidas Bhanot Publishers*
- *Introduction to Healthcare, Dakota Mitchell and Lee Haroun, Delmar*
- *Introduction to Healthcare and Careers, Roxann Delaet, Joanes and Bartlett Learning*
- *Medical Terminology, Documentation and Coding, Anne P. Stich, Routledge Publisher*
- *Medical Terminology for Health Professions, Ann Ehrlich, Carol L. Schroeder, Cengage Learning*
- *Medical Terminology, M. Mastenbjörk M.D. S. Meloni M.D. Medical Creation David Andersson, Medical Creations*
- *Medical Records: Organization and Management, GD Mogli (Author), Jaypee Brothers Medical Publishers*

Course Title: English and Communication Skills*	L	T	P	Cr.
Course Code: DMRI105	2	0	0	2

Total Hours 30 hrs

Course Outcomes: At the end of the course students will be able to...

1. Demonstrate an understanding of basic English grammar, including parts of speech, tenses, number, gender, and appropriate vocabulary usage.
2. Read, comprehend, and summarize prescribed texts and identify key information from written materials.
3. Develop effective written communication skills through letter writing, note-taking, précis writing, diary writing, essays, and resume/CV preparation.
4. Prepare official correspondence, including applications, notices, circulars, replies to official communications, charge memos, summaries, and reports related to health problems.
5. Demonstrate effective spoken English through formal and informal conversations, debates, telephone conversations, interviews, expressing opinions, and public speaking.

COURSE CONTENTS

Language-Basic

- Content: Review of grammar, Remedial study of grammar, building vocabulary Introduction
- Parts of speech
- Exercise on use of grammar Tense, Number, Gender

Assessment methods:

- Objective type, Fill in the blanks.
- Content: Read and comprehend prescribed course books Reading, Summarizing, Comprehension

Assessment methods:

- Fill in the blanks and one-mark questions
- Content: Various Forms of Composition Letter writing Note taking Precise writings Diary writing Reports on health problem etc.
- Official correspondence: Outgoing correspondence, replying incoming correspondence, writing circulars, notices, charge memos, note taking,

writing summaries, observation reports. Teaching learning activities:
Exercise on writing: Letter writing, resume/CV Essay writing.

Assessment methods:

- Applications, short reports to be written.
- Content: English- Spoken mode, Debates, Telephonic conversion, formal & informal conversation: Agreeing emphasizing, interrupting, politely, opinions, interviews, visual presentation.
- Teaching learning activities: Participating in seminar, Telephonic conversion, conversation in different situations, practice in public speaking

Assessment methods:

- Assessment of the skills based on the checklist.
- Content: Listening to comprehension media, audio, video, speeches, definition of listening, types of listening, purposes of listening, obstacles for listening, contexts of listening, to be a good listener, listening to a lecture etc.
- Teaching learning activities: Listening to audio, video tapes and identify the key points.

Assessment methods:

- Practical test of listening and filling out the blanks, essay type.

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Communicative English for General Nursing Students*, Tom Koork kakala
- *Ellison, John. How to Write and Speak Better. Reader's Digest Association.*
- *Deshpande, Ashwini. Communication and Soft Skill Development. Career Publications.*

Course Title: Clinical Education I	L	T	P	Cr.
Course Code: DMRI106	0	0	20	4

Total Hours 300 hrs (20 hrs/week × 15 weeks)

Course Outcomes: At the end of the course students will be able to...

1. Apply the principles of radiation physics (interaction, attenuation, inverse square law, exposure factors) during routine X-ray procedures.
2. Correlate anatomy and physiology with radiographic imaging to identify normal structures and optimize imaging parameters.
3. Demonstrate understanding of X-ray equipment operation and exposure parameter selection (kVp, mAs, distance) in clinical settings.
4. Implement radiation protection principles (ALARA, shielding, collimation, dose optimization) during observational clinical practice.
5. Exhibit effective patient communication and basic patient care skills during radiographic procedures, ensuring patient safety and comfort.
6. Evaluate image quality and identify common errors/artifacts, relating them to underlying physical principles and suggesting corrective measures.

INTEGRATED STUDENTSHIP PLAN

SL. No.	Observation	Integrated Learning (Radiation Physics + Anatomy + Physiology + Communication)
1	Hand Radiography	Interaction of X-rays with bone (photoelectric effect), hand anatomy, positioning communication
2	Wrist Radiography	Beam attenuation, joint anatomy, exposure factors, patient instruction
3	Forearm Radiography	Radiation intensity variation, long bone anatomy, positioning explanation
4	Elbow Radiography	Scatter radiation, joint physiology, communication during movement
5	Shoulder Radiography	X-ray penetration, muscle anatomy, patient handling
6	Chest Radiography	High kVp technique, Compton scattering, lung physiology, breathing instructions

7	Abdomen Radiography	Soft tissue attenuation, exposure selection, patient preparation
8	Pelvis Radiography	Radiation absorption in dense bone, gonadal protection, consent
9	Spine Radiography	Beam alignment, vertebral anatomy, radiation dose considerations
10	Skull Radiography	X-ray attenuation in skull, beam angulation, patient communication
11	Sinus Radiography	Air vs bone contrast, sinus anatomy, positioning explanation
12	Mobile Radiography	Inverse square law, radiation protection, bedside communication
13	Radiation Protection	ALARA, shielding, filtration, practical exposure control
14	Quality Assurance	Image quality, artifacts, exposure errors, correction techniques
15	Integration & Revision	Case-based learning integrating physics, anatomy, physiology and communication

2ND SEMESTER

Course Title: Basic of Biochemistry	L	T	P	Cr.
Course Code: DMRI201	3	0	0	3

Total Hours 45 hrs**Course Outcomes:** At the end of the course students will be able to...

1. Understand the responsibility of health care personals and hazards faced in the clinical laboratory
2. Explain the different types, use, care and maintenance of laboratory apparatus and instruments.
3. Understand the fundamental chemistry and knowledge of different solutions
4. Understand what acids, bases, salts and indicators are and also know about acid base balance
5. Describe the sample collection procedure to analyse various biochemical parameters
6. Describe assimilation of nutrients and consequences of malnutrition
7. Understand the different functional tests like LFT (Liver function test), RFT (Renal function test)
8. Understand the overview of tumor markers, cardiac markers, blood sugar and GTT, lipid profile and diagnostic enzymology
9. Describe the applications of radioisotopes

COURSE CONTENTS**UNIT-I****11 Hours****Nutrition**

Calorific value Nitrogen Balance Respiratory quotient BMR Nutritional importance of carbohydrate, lipids, proteins, vitamins and minerals Emphasis on parenteral nutrition.

UNIT-II**11 Hours****Acid-Base Balance**

Henderson Hassel Bach equation Buffers of the body fluids, Ph regulation,

Disturbance in acid base balance Anion gap Basic principles & estimation of blood gases and ph.

Water & Electrolyte balance

Overview of water and electrolyte balance Basic principles in estimation of Electrolyte. Normal values and interpretation

UNIT-III**11 Hours****Clinical chemistry-Brief overview of normal values and interpretation of results**

Renal function tests Liver function tests Tumour markers Cardiac markers

Diagnostic Enzymology

Lipid profile

Blood sugar and GTT

Normal & Abnormal urine analysis

UNIT-IV**12 Hours**

Radioisotopes: Definition, Application & Hazards, Radioimmunoassay (RIA), Normal and abnormal urine analysis Clinical charts on LFT, RFT and diagnostic enzymology

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Text Book of biochemistry for dental students, Vasudevan, Sreekumari, Kannan Vaidyanathan, Jaypee Brothers*
- *Biochemistry for Physiotherapy and allied health sciences students, Nandini M, Beena V Shetty, Vinitha Ramanath Rai, Jaypee Brothers Medical Publisher (India)*
- *Clinical chemistry, Varley, CBS Publishers & Distributors*

- *Textbook of biochemistry for paramedical students, P Ramamoorthy, Jaypee Brothers Medical Publishers*

Course Title: Conventional Radiography Equipment	L	T	P	Cr.
Course Code: DMRI202	4	0	2	5

Total Hours 60 hrs

Course Outcomes: At the end of the course students will be able to...

1. Describe the structure and working of x-ray tube, production of x-rays
2. Describe the types of x-ray tube and heat dissipation methods
3. Explain the x-ray generator circuits
4. Describe the different circuit types
5. Describe the meters and exposure timers
6. List the control of scattered radiation
7. Describes about the fluoroscopy
8. Explains about the care and maintenance of x-ray equipment's

COURSE CONTENTS

UNIT-I

08 Hours

X-ray tube: Historical aspects, construction of X-ray tubes- Crookes tube, Coolidge tube, gas filled x-ray tube. Stationary anode X-Ray tube- Construction and working, Thermionic Emission. Anode angle, heel effect, space charge, off focus radiation, tube insert and housing

Production of x-rays: Characteristic X-Rays, Bremsstrahlung radiation. Continuous and characteristics spectrum of x - rays, Rating chart, Cooling chart, Factors affecting quality and quantity of X-Rays

UNIT-II

06 Hours

Rotating anode x - ray tube: construction and working, Speed of rotating anode, Dual focus, Practical consideration in choice of focus, focal spot size, anode heel effect, inherent filter and added filter, their effect on quality of the spectrum.

Grid controlled and high-speed tubes: Construction and working, Ceramic tubes.

Heat dissipation methods: Heat units-calculation and Overload protection. Heat dissipation methods.

UNIT-III

08 Hours

X-Ray circuit: Diode, Triode, Semiconductors, Transistors, Forward and reverse bias. Rectification- Half wave and full wave. Transformers- Construction and types. Filament circuit, kV circuit. X-Ray primary and secondary circuits.

Simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.

UNIT-IV

08 Hours

X-ray generator and interlocking circuits:

H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment, Capacitors discharge and grid control systems. Fuses, switches-Mechanical, toggle and relay switch. Circuit breaker (locker) -Exposure switching -HT cables-earthing.

UNIT-V

08 Hours

Meters and exposure timers: Moving coil galvanometer: construction and working/conversion to millimetre, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimetre, digital panel meters. Clockwork timers, mAs timer, Pulse counting timer, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber-based timers, integrated timer.

Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; Filters- inherent filters, added filters, heavy metal filters, grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.

UNIT-VI

10 Hours

Mammography:

Historical aspects, construction of X-ray tubes, construction and working, Speed of rotating anode, Practical consideration in choice of focus, focal spot size, anode heel effect, inherent filter and added filter, their effect on quality of the spectrum.

UNIT-VII

08 Hours

Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed-circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid-controlled x-ray tube.

UNIT-VIII

04 Hours

Care and Maintenance of X-ray equipment;

General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.

SUGGESTED PRACTICALS/DEMONSTRATION (30 Hours)

- X-ray tube; Production of x-rays
- Rotating anode x - ray tube; Grid controlled and high-speed tubes; Heat dissipation methods
- X-ray circuits
- X-Ray generators and Interlocking circuits; Relays
- Meters and exposure timers
- Control of scattered radiation: Beam limiting devices
- Fluoroscopy
- Care and Maintenance of X-ray equipment

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Radiographic Imaging (Cbs)* I.C.R.P., D.N. Chesney & M.O Chesney, CBS Publishers & Distributors
- *An Introduction of Physics to Diagnostic Radiography*, Christensen, Curry & Dowdey, Lea & Febiger
- *Radiological Science for technologists*, Stewart C Bushong, Mosby
- *Equipment for Diagnostic Radiography*, E. Forster, Springer Dordrecht
- *The Physics of Radiology And Imaging*, K Thayalan, Jaypee
- *Concise Text Book on Imaging modalities & Recent Advances In Diagnostic Radiology*, Dr. K.B. Gehlot, Lalit Agarwal, JBD Publications

Course Title: Clinical Radiography Positioning I	L	T	P	Cr.
Course Code: DMRI203	4	0	6	7

Total Hours 60 hrs

Course Outcomes: At the end of the course students will be able to...

1. Understand the basic patient positioning during radiographic investigation.
2. Apply special positioning skills for different pathological and physical conditions.
3. Application of equipment while working in radiology departments.
4. Choose proper position during radiography.
5. Explain relative positions of x-ray tube and patient relevant exposure factors during radiography.
6. Explain the use of accessories.
7. Explain the anatomic and physiological basis of the procedure to be undertaken.
8. Explain the radiographic appearances of both normal and common abnormal conditions.

COURSE CONTENTS

UNIT-I

07 Hours

Principles of Radiography:

Preparation of the Room, Apparatus and Instruments Positions of the Patient: Erect, Sitting, Supine, Prone, Lateral, Oblique, Decubitus Etc. Relative position of X-Ray tube and patient, relevant exposure factors. Use of accessories such as radiographic cones, grid and positioning aids. Anatomic and Physiological basis of the procedure, Association with theory with practical work. Radiographic appearances, both normal and common abnormal conditions where elementary knowledge of the pathology involved will ensure the application of the appropriate radiographic technique. Modifications in technique for various disabilities and types of course. Radiation protection, use of gonad shield, practical methods of reducing radiation dose to the patient.

UNIT-II

10 Hours

Upper limb:

Routine projections for the whole hand, fingers, wrist joint, forearm, elbow joint and humerus.

Supplementary projections for Scaphoid, Carpal tunnel, Ball Catchers projections, Head of the Radius, Supracondylar fracture and Olecranon process

UNIT-III

10 Hours

Lower limb:

Routine projections for the whole foot, toes, calcaneum, ankle joint, leg, knee-joint, patella and femurs.

Supplementary projections for Talo-Calcaneal joint, Forced projections for torn ligaments, Flat Feet, Club Feet, Intercondylar projections for loose bodies in the knee, Axial projection for Patella.

UNIT-IV

10 Hours

Shoulder Girdle and Thorax:

Routine projections for the shoulder joint, Scapula, Acromio Clavicular joint, Clavicle, Sternoclavicular joint, Sternum and Ribs.

Supplementary projections for the axial projection of Clavicle, Bicipital groove, Coracoid process.

UNIT-V

11 Hours

Lung and Mediastinum:

Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions.

Abdominal viscera- Technique for plain film examination. - Projection for acute abdomen patients. - Technique to demonstrate: Foreign bodies, Imperforate anus.

Supplementary techniques. Upper respiratory system Technique for postnasal airways, larynx, trachea, thoracic inlet and Valsalva manoeuvre. - Phonation.

UNIT-VI**12 Hours****Pelvic girdle and hip region:**

Routine projections for the whole pelvis, Sacro-Ileac joints, hip joint and Neck of Femur.

Supplementary projections for the greater and lesser trochanters of Femur.

Frog leg projection, Ischium, Symphysis Pubis, Ileum, Acetabulum and Congenital Dislocation of Hip, Arthrodesis.

Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.

SUGGESTED PRACTICALS/DEMONSTRATION (90 Hours)

- Principles of Radiography
- Upper limb
- Lower limb
- Shoulder Girdle and Thorax
- Chest
- Pelvic girdle and hip region, Skeletal survey

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Atlas of Radiographic Positioning and Radiological Procedures*, Philip W Ballinger, Eugene D. Frank, Mosby
- *Clarks Positioning in Radiography*, Ra Swallow, E Naylor, Lippincott Williams and Wilkins
- *Merrill's Atlas of Radiographic Positioning and Procedures*, Bruce W. Long & Jeannean Hall Rollins & Barbara J. Smith Bruce W. Long & Jeannean Hall Rollins & Barbara J. Smith, Mosby
- *Bontrager's Textbook of Radiographic Positioning and Related Anatomy*, John Lampignano and Leslie E Kendrick, Elsevier Science

- *Radiology of Positioning and Applied Anatomy for Students and Practitioners, Garkal Gs, Jaypee Brothers Medical Publishers*
- *Manual of Radiographic Positioning, S. Tamijeselman, JBD Publications*

Course Title: Basic Computers and Information Science*	L	T	P	Cr.
Course Code: DMRI204	2	0	0	2

Total Hours 30 hrs

Course Outcomes: At the end of the course students will be able to...

1. Explain the basic concepts, characteristics, generations, and components of computers.
2. Identify and describe various input devices, output devices, processors, memory units, and storage devices.
3. Demonstrate basic operations of the Windows operating system, including file management, folder creation, and desktop navigation.
4. Create, edit, format, save, and print documents using MS Word, including tables and mail merge.
5. Use MS Excel to enter data, format worksheets, perform basic calculations, and create graphs.
6. Develop and deliver presentations using MS PowerPoint with appropriate text formatting, layouts, and graphical elements.
7. Describe the functions and types of operating systems, computer networks, and network topologies.
8. Explain the basic concepts of the Internet, email, web browsers, and other Internet services.
9. Describe the applications of computers in clinical and healthcare settings.
10. Demonstrate practical computer skills, including MS Office applications, software installation, and accurate data entry.

COURSE CONTENTS

UNIT-I

02 Hours

Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.

UNIT-II

02 Hours

Input output devices: Input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices (monitors, pointers, plotters, screen image projector, voice response systems).

UNIT-III**02 Hours**

Processor and memory: The Central Processing Unit (CPU), main memory.

UNIT-IV**02 Hours**

Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

UNIT-V**02 Hours**

Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).

UNIT-VI**03 Hours**

Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.

UNIT-VII**03 Hours**

Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.

UNIT-VIII**03 Hours**

Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

UNIT-IX**03 Hours**

Introduction of Operating System: introduction, operating system concepts, types of operating system.

UNIT-X**02 Hours**

Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.

UNIT-XI

02 Hours

Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.

UNIT-XII

04 Hours

Application of Computers in clinical settings. Practical on fundamentals of computers –

- Learning to use MS office: MS word, MS PowerPoint, MS Excel.
- To install different software.
- Data entry efficiency

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Basic of Computer and Information Technology*, Ashok Arora, Vikas
- *Computer and Information Science*, Roger Lee (editor), Springer
- *Information science and computer basics: An introduction*, Mitchell, Ruth K, Clive Bingley

Course Title: Clinical Education II	L	T	P	Cr.
Course Code: DMRI205	0	0	15	3

Total Hours 225 hrs (15 hrs/week × 15 weeks)

Course Outcomes: At the end of the course students will be able to...

1. Demonstrate professional behaviour, communication skills and ethical practices in radiology departments.
2. Prepare patients, equipment and examination rooms for routine radiographic procedures.
3. Perform basic radiographic positioning techniques under supervision.
4. Operate radiographic equipment with understanding of exposure parameters.
5. Assist in special radiographic and fluoroscopic procedures.
6. Maintain records, logbooks and adhere to quality assurance protocols.

INTEGRATED STUDENTSHIP PLAN

Unit	Topic and contents	Hours
I	Orientation to Radiology Department • Structure and workflow of radiology department • Roles of radiographic assistance and healthcare team • Professional ethics and patient confidentiality • Communication skills (patient handling, consent) • Introduction to radiology records and documentation	15
II	Patient Care & Preparation • Patient identification and verification protocols • Patient preparation for radiographic procedures • Handling special patients: ▪ Trauma patients ▪ Pediatric patients ▪ Geriatric patients ▪ Critically ill patients • Infection control and universal precautions • Contrast media basics (observation only)	30
III	Radiographic Equipment Handling	30

	• Familiarization with X-ray equipment • Positioning of X-ray tube and patient • Exposure parameter selection (kVp, mAs, SID) • Use of accessories: ▪ Grids ▪ Cassettes/DR systems ▪ Immobilization devices • Equipment safety checks	
IV	Perform routine and Supplementary projections positioning techniques: (These studentships must be done under supervision of faculty/senior staff) • Upper Limb ▪ Hand, ▪ wrist, ▪ forearm, ▪ elbow, ▪ humerus • Lower Limb ▪ Foot, ▪ ankle, ▪ leg, ▪ knee, ▪ femur • Chest & Abdomen ▪ Chest PA/AP ▪ Abdomen erect/supine ▪ Pevis	150
	TOTAL	225

3RD SEMESTER

Course Title: Basic of Microbiology	L	T	P	Cr.
Course Code: DMRI301	3	0	0	3

Total Hours 45 hrs**Course Outcomes:** At the end of the course students will be able to...

1. Describe the structure, classification, morphology and growth of bacteria
2. Describe the methods of sterilisation and disinfection and their applications
3. Explain the concepts of immunity, hypersensitivity and immunisation
4. Describe Nosocomial infections and methods for the prevention of hospital acquired infections
5. Describe the management of biomedical waste
6. List the common fungi and viruses and explain their importance

COURSE CONTENTS**UNIT-I****12 Hours**

Morphology of Bacteria: (Structure, size, shape, arrangement cell wall, flagella, spore, capsule, fimbria), **Physiology of Bacteria:** (Bacterial growth curve, Temp, O₂, CO₂, micro and macro nutrient growth requirements), Culture Media, Culture Methods, Antimicrobial sensitivity tests

Sterilization and Disinfections: Definition, Dry heat Sterilization, Moist heat Sterilization, Chemical disinfectants, Gaseous disinfection, Test for disinfection/ Sterilization control

UNIT-II**10 Hours**

Infection: Classification, Sources of infection, Modes of transmission: Nosocomial infection including biomedical waste management: Definition, Classification, Significance, Prevention and control, Biomedical waste management

UNIT-III**06 Hours**

Immunology: Immunity, Antigen, Antibody, Hypersensitivity

UNIT-IV**09 Hours**

General Properties of fungi. (General characters, classification, Morphology, Reproduction) General Properties of Viruses. (General character, classification based on Genome, Capsid, Envelope & replication and cultivation of virus).

UNIT-V**08 Hours**

Applied Microbiology: Pyrexia of unknown origin, Meningitis, Zoonotic infections, Hepatitis, HIV infection and AIDS, Food poisoning, Diarrhea, Urinary tract infections, Pulmonary Tuberculosis

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Text book of Microbiology, Ananthnarayana & Panikar, University Press*
- *Text book of Microbiology, Baveja, University Press*
- *Text book of Microbiology, Sathish Gupte, JPB*
- *Text book of Microbiology, Dr. Arora, CBS Publishers & Distributors Pvt. Ltd*

Course Title: Clinical Radiography Positioning III	L	T	P	Cr.
Course Code: DMRI302	4	1	6	8

Total Hours 60 hrs

Course Outcomes: At the end of the course students will be able to...

1. Prepare management and positioning of patients
2. Correlate of indications, contraindications of the patient
3. Understand the patient preparations needed before any radiological examination.
4. Generalize knowledge of post procedural care.
5. Students will be able position the patients for radiological procedures.
6. Knowledge of image quality in radiological images.
7. Management of patients in radiology department for various procedures.
8. Ability to handle emergency situations in radiology department.

COURSE CONTENTS

UNIT-I

15 Hours

Skull:

Routine projections for cranium and facial bones; Supplementary projections for trauma, Towne's method, Sella turcica, Optic foramina, Jugular foramina, Temporal bones, Mastoids, Petrous bone, Zygomatic arches, Orbits, Maxillae, Nasal bones, Mandible, Temporomandibular joints.

Nasal Sinuses: Techniques for Frontal, Maxillary, Ethmoidal and Sphenoid Sinuses, erect and horizontal projections for fluid levels.

UNIT-II

10 Hours

Dental Radiography

Technique for intraoral full mouth. - Occlusal projections.

Extraoral projections, including orthopantomography.

UNIT-III

15 Hours

Vertebral Column:

Routine projections for Atlanto-Occipital joint, cervical spine, Cervico-thoracic Junction, thoracic Spine, lumbar Spine, Lumbo-Sacral Region, Sacrum and Coccyx.

Supplementary projections for the intervertebral foramina, posterior arch of Atlas, Flexion and Extension of Cervical Spine, Scoliosis and Kyphosis, Sacro Iliac Joint.

UNIT-IV

05 Hours

Radiography using mobile X-ray equipment:

Radiography in the ward: Radiography in the specialised unit, such as: Intensive care unit, Coronary care, Neonatal unit and Radiography in the operating theatre.

Mammography: Basic views, special views, wire localization. Localisation of foreign bodies. Various techniques

UNIT-V

05 Hours

Ward /mobile radiography: electrical supply, radiation protection, equipment and Instructions to be followed for portable/ward radiography. Operation theatre techniques: General precautions, Asepsis in techniques - Checking of mains, supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid, processing techniques.

Trauma radiography/Emergency radiography

UNIT-VI

05 Hours

Neonatal and Paediatric Radiography, Forensic Radiography
Microradiography: General principles, Requirement, Equipment, Technique.

UNIT-VII

05 Hours

Soft Tissue Radiography: High and low kilo voltage technique; differential filtration.

Non - screen technique - simultaneous screen and non -screen technique.

Multiple radiography, Uses of soft tissue radiography.

High kV Radiography: General principles. Relation to patient dose, Change in radiographic contrast. Scatter elimination; beam collimation; grid ratio. Speed and type of grid movement.

Radiographic factor: application and uses.

UNIT-VIII

05 Hours

Localisation of foreign bodies:

General location principles. Ingested, inhaled, inserted, embedded foreign bodies.

Foreign bodies in the eye.

Preparation of the area to be investigated.

Appropriate projection for all Techniques to locate non-opaque foreign body.

SUGGESTED PRACTICALS/DEMONSTRATION (90 Hours)

- Skull radiography
- Dental Radiography; Upper respiratory system
- Vertebral Column
- Radiography in the ward; Mammography
- Ward /mobile radiography
- Neonatal and Pediatric Radiography; Forensic Radiography
Microradiography
- Soft Tissue Radiography Multiple Radiography High kV Radiography
Scatter elimination; beam collimation; grid ratio, speed and type of grid movement, Radiographic factor; application and uses.
- Localization of foreign bodies

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Radiological positioning, Merlis, Mosby*
- *A guide to Radiological positioning, Clarks, CBS publishers and distributors pvt. Ltd*
- *Radiology of Positioning and Applied Anatomy for Students and Practitioners, Garkal Gs, Jaypee Brothers Medical Publishers*
- *Bontrager's Textbook of Radiographic Positioning and Related Anatomy, John Lampignano, Leslie E. Kendrick, Mosby*

Course Title: X-ray Image Processing	L	T	P	Cr.
Course Code: DMRI303	3	0	2	4

Total Hours 45 hrs

Course Outcomes: At the end of the course students will be able to...

1. Know basic physics of radiography processing system
2. Describe construction and working of film, intensifying screen, cassette, dark room and automatic processor
3. Explain radiographic film Processing chemistry
4. Discuss the factors affecting image quality in radiographic image and their application
5. Operate the workflow in x-ray imaging
6. Apply knowledge for the use of radiation factors
7. Demonstrate process the radiographic film in different systems
8. Prepare care and maintenance of radiographic films, cassettes, intensifying screens, darkroom accessories and X-ray equipment

COURSE CONTENTS

UNIT-I

11 Hours

Photographic Principles:

Radiographic film- construction and types; Photographic effect and latent image formation; Film density and log relative exposure; Characteristic curve – its formation and features; Spectral response; Film faults and Artefacts

Intensifying Screens: Luminescence-fluorescence and phosphorescence; Construction and types of Intensifying Screens; Intensification Factor, quantum detection and conversion efficiency; Film screen matching; Resolving power of Intensifying Screens; Speed of intensifying screen; Screen film contact tests; Advantages and limitations of Intensifying Screens

X-ray Cassette: Construction of X-ray cassettes; Types of cassettes; Mounting Intensifying Screens on cassettes; Care and maintenance of cassettes

UNIT-II

08 Hours

Dark Room – Planning & Construction:

Planning for a small & large Hospital; Location of Dark Room; Construction of Dark Room; Ventilation; Wall Protection; Entrance to Dark Room - Single Door, Double Door, Labyrinth

Dark Room Accessories: Dry bench; Hopper, Drawer, Cupboard; Loading and unloading cassettes; Hangers, types of hangers and storage of hangers; Wet bench; Cleanliness, control of dust, dark room sinks; Hatches; Drier; Safe Lights-types and uses, factors affecting safelight performance, safelight Tests; Viewing room, Film dispensing

UNIT-III

07 Hours

Film Processing: Photochemistry.

Developer; Rinsing; Fixer; Washing and drying; Preparation of processing solutions; Manual processing apparatus; Effect of temperature in processing; Rapid processing

Automatic processor: Principle of working and features, thermal regulation and replenishment system; Care and maintenance of automatic processor; Advantages and limitations of automatic processor

UNIT-IV

10 Hours

Computed Radiography and Digital Radiography

UNIT-V

06 Hours

The Radiographic Image:

The emergent beam related to densities on film contrast – objective and courseive Radiation contrast, film contrast and Radiographic contrast-Density, Sharpness, Unsharpness

Resolution: Factors affecting resolution, choice of Kilovolt age and Mill amperage, Choice of Short Focus and Broad Focus, selection of Focus to Film Distance and Object to Film Distance selection of cassettes, Avoiding scatter radiation, magnification, distortion, penumbra Reproduction of

Radiographs: Copying Radiographs, Magnification and Minification Radiography

Imaging Communication: Hospital Information System, Radiology Information System, PACS, DICOM

SUGGESTED PRACTICALS/DEMONSTRATION (30 Hours)

- Radiographic film; Intensifying Screens; X-ray Cassette
- Dark Room – Planning & Construction
- Film Processing; Photochemistry
- Computed Radiography and Digital Radiography
- The emergent beam related to densities on film contrast – objective and courseive Radiation contrast, film contrast and Radiographic Contrast-Density, Sharpness, Unsharpness; Factors affecting resolution; Reproduction of Radiographs

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Radiographic Imaging (Cbs)I.C.R.P. Radiographic Imaging (Cbs)I.C.R.P., D.N. Chesney & M.O Chesney, Blackwell Scientific*
- *An Introduction of Physics to Diagnostic Radiography, Christensen, Curry & Dowdey, Lea & Febiger*
- *Radiological Science for technologists, Stewart C. Bushong, Mosby*

Course Title: Principles of Management*	L	T	P	Cr.
Course Code: DMRI304	2	0	0	2

Total Hours 30 hrs

Course Outcomes: At the end of the course students will be able to...

1. Explain the basic concepts, principles, functions, and importance of management in organizations. Describe the principles of strategic management and their role in achieving organizational goals.
2. Apply the fundamentals of planning to establish objectives and prepare effective action plans. Identify and use appropriate planning tools and techniques for organizing and managing tasks.
3. Explain decision-making processes and apply basic techniques for managing conflicts and workplace stress. Describe the process of organizational change and identify strategies to encourage innovation.
4. Explain group dynamics and demonstrate effective teamwork and collaboration skills. Describe different leadership styles and their application in managing individuals and teams.
5. Apply time-management techniques to prioritize tasks and improve productivity. Explain the concepts of cost control, resource utilization, and operational efficiency in organizational settings.

COURSE CONTENTS

- Introduction to management
- Strategic Management
- Foundations of Planning
- Planning Tools and Techniques
- Decision Making, conflict and stress management
- Managing Change and Innovation
- Understanding Groups and Teams
- Leadership
- Time Management
- Cost and efficiency

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Essentials of Professionalism, Professional Values & Ethics for BSc Nursing Students, Varinder Kaur, CBS Publishers and Distributors Pvt. Ltd*
- *Professionalism, Professional Values and Ethics in Nursing, Suresh K Sharma, Jaypee Brothers*
- *Professionalism, Professional Values & Ethics, Shama Lohumi and Rakesh Lohumi, CBS publishers and Distributers PVT Ltd*

Course Title: Clinical Education III	L	T	P	Cr.
Course Code: DMRI305	0	0	15	3

Total Hours 225 hrs (15 hrs/week × 15 weeks)

Course Outcomes: At the end of the course students will be able to...

1. Demonstrate professional behaviour, communication skills, ethical practices and management in radiology department.
2. Prepare patients, equipment, positioning and examination rooms for routine radiographic procedures.
3. Perform basic radiographic positioning techniques under supervision.
4. Operate radiographic equipment with understanding of machine and exposure parameters.
5. Assist in radiographic positioning and fluoroscopic procedures.
6. Maintain records, logbooks and adhere to quality assurance protocols.

INTEGRATED STUDENTSHIP PLAN

Unit	Topic and contents	Hours
I	Skull and Nasal Sinuses Routine projections and Supplementary projections.	60
II	Dental Radiography Technique for intraoral full mouth. - Occlusal projections. Extraoral projections, including orthopantomography.	30
III	Vertebral Column: • Routine projections and Supplementary projections.	60
IV	Radiography using mobile X-ray equipment: Radiography in the ward: Radiography in the specialised unit, such as: Intensive care unit, Coronary care, Neonatal unit and Radiography in the operating theatre. • Mammography: Basic views, special views,	30
V	Ward /mobile radiography: electrical supply, radiation protection, equipment and Instructions to be followed for portable/ward radiography. Operation theatre techniques: General precautions, Asepsis in techniques - Checking of mains, supply and functions of equipment, selection of exposure factors, explosion risk, radiation	25

	protection and rapid, processing techniques. Trauma radiography/Emergency radiography	
VI	Neonatal and Paediatric Radiography, Forensic Radiography and Microradiography. Soft Tissue Radiography. Non - screen technique. Localisation of foreign bodies.	20
	TOTAL	225

4TH SEMESTER

Course Title: Hospital Practice and Patient Care	L	T	P	Cr.
Course Code: DMRI401	2	0	2	3

Total Hours 30 hrs**Course Outcomes:** At the end of the course students will be able to...

1. Understand the responsibility of the imaging technologist and other health care facility.
2. Understand the management and care of patient during different procedures and emergency situations.
3. Know about different patient transfer techniques and to restrain the uncooperative patients during radiological examination
4. Differentiate the types of consent forms
5. Know about infection control, infection source and isolation techniques
6. Describe sterilization techniques
7. Understand the radiation safety and protection

COURSE CONTENTS**UNIT-I****03 Hours**

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

UNIT-II**04 Hours**

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.

UNIT-III**03 Hours**

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.

UNIT-IV

05 Hours

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.

UNIT-V

05 Hours

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)

UNIT-VII

05 Hours

Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control

Departmental procedures: Department staffing and organisations; 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.

UNIT-VIII**05 Hours**

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

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Patient care in radiography, Ruth Ann Ehrlich, Dawn M Coakes, Mosby*
- *Patient care in radiography: with an introduction to medical imaging, Ruth Ann Ehrlich and Joan A. daly, St. Louis, Mo.: Mosby Elsevier*
- *Care of the Patient in Diagnostic Radiography, D. Noreen Chesney and Muriel O. Chesney*

Course Title: Radiological Procedures	L	T	P	Cr.
Course Code: DMRI402	3	0	4	5

Total Hours 45 hrs

Course Outcomes: At the end of the course students will be able to...

1. Prepare management and positioning of patients while performing radiological procedures.
2. Correlate of indications, contraindications, contrast media, radiation dose, exposure timing and radiation safety measures for different radiological procedures.
3. Understand the patient preparations needed before any radiological examination.
4. Generalize knowledge of post procedural care.
5. Students will be able position the patients for radiological procedures.
6. Knowledge of image quality in radiological images.
7. Management of patients in radiology department for various procedures.
8. Ability to handle emergency situations in radiology department.
9. Precautions and care required in interventional suits.

COURSE CONTENTS

UNIT-I

10 Hours

Introduction: General approach to Special Radiographic procedures, Responsibility of Radiology Technologist during radiological procedures, Preparation of patient for different procedures, Room layout in interventional radiology and fluoroscopy.

Contrast Media: Positive and Negative, Ionic & Non-Ionic, Adverse Reactions to contrast media and patient management.

Emergency Equipment in the Radiology Department

UNIT-II

15 Hours

Gastro Intestinal Tract: Barium Swallow; Barium Meal - Single and Double Contrast; Barium Meal Follow Through; Small Bowel Enema (Enteroclysis); Barium Enema - Gastrograffin Enema; Loopogram

Biliary Tract: Oral & Intravenous Cholecystography; Percutaneous Transhepatic Cholangiography; Percutaneous Transhepatic Biliary Drainage; Endoscopic Retrograde Cholangiopancreatography

UNIT-III

10 Hours

Urinary System: IVU (Intravenous Urography), Retrograde Pyeloureterography (RGU), Micturating Cysto Urethrography, Ascending Urethrography

Reproductive System: Hysterosalpingogram, FTR (Fallopian Tube Recanalization)

UNIT-IV

10 Hours

Central Nervous System: Cervical Myelography - Cisternal Puncture and Lateral Cervical Puncture, Lumbar Myelography, Myelography with water soluble and oily contrast media

Respiratory System: Bronchography, Percutaneous Lung Biopsy

Other procedures in radiology: Arthrography, Sialography, Lymphography, Sinography & Fistulography, Dacrocystography, Embolization & embolic agents

SUGGESTED PRACTICALS/DEMONSTRATION (60 Hours)

- General approach to special radiographic procedures, responsibility of radiology technologist during radiological procedures
- Contrast media and their adverse reactions to contrast media and patient management
- Procedures for gastrointestinal tract including barium studies
- Procedures for biliary tract
- Procedures for urinary system and reproductive system
- Procedures for central nervous system and respiratory system

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Radiographic Imaging, Bhushan and Lakkhar, Arya Publications*
- *A guide to radiological procedures, Chapman, Elsevier*
- *Fundamentals of Special Radiographic Procedures, Albert M. Snopek*

Course Title: Radiation Safety and Quality Assurance in Radiography	L	T	P	Cr.
Course Code: DMRI403	3	0	2	4

Total Hours 45 hrs

Course Outcomes: At the end of the course students will be able to...

1. Aim and need of radiation protection
2. Introduction to Radiation units and quantities
3. Understanding of various Radiation protection regulations and the dose limits
4. Radiation protection to patients, occupational workers and general public in Diagnostic Radiology
5. Layout of Radiology department
6. Use of protective devices and awareness of radiation with radiation signages
7. Dose reduction measures with technical protective considerations during radiology
8. Different radiation measuring devices
9. Effects of radiation on biological tissue
10. Aim and need of radiation protection
11. Introduction to quality assurance
12. Understanding of regulatory requirements
13. Follow radiation protection regulations and apply practically

COURSE CONTENTS

UNIT-I

05 Hours

Radiation Quantities and Units: Radiation- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor - Flux-Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public.

UNIT-II

05 Hours

Biological Effects of radiation: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effects- stochastic and deterministic effects Acute exposure and chronic

exposure-LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.

UNIT-III

05 Hours

Radiation detection and Measurements: Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters- scintillation detectors – liquid semiconductor detectors – Gamma ray spectrometer. Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter – chemical dosimeter- Thermoluminescent Dosimeter. -Pocket dosimeter Radiation survey meter- wide range survey meter -zone monitor-contamination monitor -their principle function and uses.

UNIT-IV

05 Hours

Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey ALARA- personnel dosimeters (TLD and film batches) - occupational exposure.

UNIT-V

05 Hours

Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors and different shielding material.

UNIT-VI

05 Hours

Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance.

Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.

Quality assurance programme at the radiological faculty level:

Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration

UNIT-VII**05 Hours****QA in Diagnostic Radiology**

filtration

Contact between film and intensifying screen

Contrast Verification of Optical and Radiation field

congruence

Beam alignment

Focal spot size

Linearity of tube current mA and Timer

Applied potential

HVT and total tube

Resolution

Grid alignment

QA in Digital Radiography

UNIT-VIII**05 Hours****Regulatory requirements in Diagnostic Radiology**

National Regulatory Body

Responsibilities and organization

Safety Standards

Codes and Guides

Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment

UNIT-IX

05 Hours

Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements Role of technologist in radiology department Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.

Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.

SUGGESTED PRACTICALS/DEMONSTRATION (30 Hours)

- Radiation Quantities and Units
- Biological Effects of radiation
- Radiation detection and Measurements Survey meter and personal dosimeter
- Radiation protection; Principles of radiation protection; ALARA
- Radiation Hazard evaluation and control
- Quality assurance programme at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration
- **QA in Diagnostic Radiology**
 - filtration
 - Contact between film and intensifying screen
 - Contrast Verification of Optical and Radiation field
 - congruence

- Beam alignment
- Focal spot size
- Linearity of tube current mA and Timer
- Applied potential
- HVT and total tube
- Resolution
- Grid alignment
- QA in Digital Radiography
- Regulatory requirements in Diagnostic Radiology
- Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements
- Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Radiation Protection in Diagnostic X-Ray Imaging, Euclid Seeram, Patrick C. Brennan, Jones and Bartlett Publishers*
- *Development of Radiation Protection in Diagnostic Radiology, Stewart C. Bushong, CRC Press Inc., U.S.*
- *Textbook of Radiological Safety, Thayalan K, Jaypee Brothers Medical Publishers*
- *Radiation Protection in Medical Radiography, Statkiewicz Sherer, Elsevier Health - US;*
- *Quality Assurance, Dr. R. Sundhararajan, M.V. Kumudhavalli, Minal T. Harde, Thakur Publications Pvt Ltd*
- *AERB Safety Guide & Code, AERB*

Course Title: Introduction to USG, CT and MRI	L	T	P	Cr.
Course Code: DMRI404	3	0	0	3

Total Hours 45 hrs

Course Outcomes: At the end of the course students will be able to...

1. Describe the historical development, basic principles, and clinical applications of Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Ultrasonography (USG) in diagnostic imaging.
2. Explain CT image formation, image reconstruction processes, Hounsfield Units (HU), CT windowing techniques, and the basic principles of ultrasound image formation, including pulse-echo, transducer function, and echogenicity.
3. Discuss the evolution of CT scanner generations, evaluate radiation safety measures and dose optimization practices in CT imaging, and explain the principles of ultrasound instrumentation, transducers, beam characteristics, and image optimization.
4. Explain the atomic structure, magnetic properties of hydrogen nuclei, spin precession, the Larmor equation, and the basic physics of ultrasound, including sound wave propagation, velocity, frequency, wavelength, attenuation, and acoustic impedance.
5. Interpret the mechanisms of MR signal generation, resonance, relaxation phenomena, and the formation of T1-weighted, T2-weighted, and Proton Density (PD) weighted images, while also explaining the interaction of ultrasound with tissues, image formation, and common ultrasound artifacts.
6. Differentiate various MRI magnet systems, radiofrequency coils, CT system components, and ultrasound transducers, and apply appropriate CT radiation safety, MRI safety, and ultrasound safety principles in clinical practice.

COURSE CONTENTS

UNIT-I

10 Hours

Ultrasonography: History, Basic principle, Transducer, Interaction and attenuation, Artifacts and Ultrasound safety

UNIT-II

05 Hours

Computed Tomography:

History, Basic principle, Image reconstruction, Hounsfield unit and CT windowing

UNIT-III

12 Hours

Generation of CT and Radiation safety in CT

UNIT-IV

13 Hours

Magnetic Resonance Imaging: History, Basic principle, Atomic structure and motion, MR active nuclei Hydrogen, spin precession, Larmor equation, MR signal, Resonance, Relaxation, T1, T2 and PD weighted images

UNIT-V

05 Hours

Types of magnets and coils, MR safety considerations

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Ultrasound physics and technology: how, why and when* Vivien Gibbs Churchill Livingstone
- *Computed Tomography: Physical Principles, Clinical Applications, and Quality Control* Euclid Seeram RT(R) BSc MSc FCAMRT (Author) Saunders
- *Computed Tomography for Technologists: A Comprehensive Text* Lois Romans Lippincott Williams and Wilkins;
- *The CT Handbook: Optimizing Protocols for Today's Feature-Rich Scanners* Timothy P. Szczykutowicz Medical Physics Publishing Corporation
- *MRI inPractice* Catherine Westbrook & Caralyn Kaut Wiley Blackwell
- *Protocols inMRI* Catherine Westbrook Wiley-Blackwell

Course Title: Medical Law and Ethics & Professionalism and Values*	L	T	P	Cr.
Course Code: DMRI405	2	0	0	2

Total Hours 30 hrs

Course Outcomes: At the end of the course students will be able to...

1. Explain the definition, goals, scope, and fundamental principles of medical ethics and professional codes of conduct.
2. Apply the principles of confidentiality, autonomy, informed consent, and patients' rights in healthcare settings.
3. Identify medical malpractice, negligence, and irrational drug therapy, and explain the importance of professional accountability.
4. Describe ethical and legal considerations related to terminally ill patients, euthanasia, and organ transplantation.
5. Explain the medico-legal aspects of medical records, medico-legal cases, documentation, confidentiality, disclosure, and record retention.
6. Describe the purpose of professional indemnity insurance and the importance of standardized protocols for preventing near-miss incidents and sentinel events.
7. Demonstrate professional values, including integrity, objectivity, competence, due care, and confidentiality.
8. Recognize the importance of personal moral values, professional behavior, equality, responsibility, and ethical decision-making in healthcare.
9. Explain professional misconduct, accountability, and the roles and responsibilities of different healthcare professionals.
10. Demonstrate an understanding of teamwork, interprofessional collaboration, and cultural sensitivity in providing ethical and patient-centered healthcare.

COURSE CONTENTS

- Medical ethics - Definition - Goal - Scope
- Introduction to Code of conduct
- Basic principles of medical ethics – Confidentiality
- Malpractice and negligence - Rational and irrational drug therapy
- Autonomy and informed consent - Right of patients
- Care of the terminally ill- Euthanasia
- Organ transplantation
- Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical

information - Unauthorized disclosure - retention of medical records - other various aspects.

- Professional Indemnity insurance policy
- Development of standardized protocol to avoid near miss or sentinel events
- Obtaining an informed consent.
- Medical ethics - Definition - Goal - Scope
- Introduction to Code of conduct
- Basic principles of medical ethics – Confidentiality
- Malpractice and negligence - Rational and irrational drug therapy
- Autonomy and informed consent - Right of patients
- Care of the terminally ill- Euthanasia
- Organ transplantation
- Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
- Professional Indemnity insurance policy
- Development of standardized protocol to avoid near miss or sentinel events
- Obtaining an informed consent.
- Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality
- Personal values- ethical or moral values
- Attitude and behavior- professional behavior, treating people equally
- Code of conduct, professional accountability and responsibility, misconduct
- Differences between professions and importance of team efforts
- Cultural issues in the healthcare environment

TRANSACTIONAL MODES

Lecture, Tutorial, Problem based learning, small group teaching and learning, Continuous interactive learning, Case-based, Project based, Seminars, Clinical conferences, E-learning, Skills laboratory, Industrial visit

SUGGESTED READING

- *Medical Law and Ethics, Bonnie F. Fremgen, Pearson*
- *Medical Law and Ethics, Jonathan Herring, OUP UK*

- *Medical Law and Ethics*, Purosottam Behera, Mittal Publications
- *Reflections on Medical Law and Ethics in India*, Bismi Gopalakrishnan, Mercy Khaute, B. Sandeepa Bhat, Eastern Law House
- *Textbook of Medical Ethics*, Erich H Loewy, Springer

Course Title: Clinical Education IV	L	T	P	Cr.
Course Code: DMRI406	0	0	15	3

Total Hours 225 hrs (15 hrs/week × 15 weeks)

Course Outcomes: At the end of the course students will be able to...

1. Demonstrate professional behavior, communication skills and ethical practices in radiology departments.
2. Prepare patients, equipment and examination rooms for routine radiographic procedures.
3. Perform basic radiographic positioning techniques under supervision.
4. Operate radiographic equipment with understanding of exposure parameters.
5. Assist in special radiographic and fluoroscopic procedures.
6. Maintain records, logbooks and adhere to quality assurance protocols.

INTEGRATED STUDENTSHIP PLAN

Unit	Topic and contents	Hours
I	General approach to special radiographic procedures, responsibility of radiology technologist during radiological procedures. Contrast media and their adverse reactions to contrast media and patient management.	15
II	Procedures for gastrointestinal tract including barium studies. Procedures for biliary tract. Procedures for urinary system and reproductive system.	30
III	Procedures for central nervous system and respiratory system Radiation Quantities and Units. Regulatory requirements in Diagnostic Radiology Role of technologist in radiology department Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book	30

	maintenance; Reject analysis and objectives of reject analysis programme. Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.	
IV	Radiation detection and Measurements. Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey –ALARA- personnel dosimeters (TLD and film batches) - occupational exposure. QA in Diagnostic Radiology.	150
	TOTAL	225

5TH SEMESTER

Course Title: Internship	L	T	P	Cr.
Course Code: DMRI501	0	0	0	20

Total Hours 1080 hrs

Minimum 1080 hours (calculated based on 8 hours per day for six months of internship).

Every candidate after passing all semesters examination is required to undergo compulsory internship to the satisfaction of the college authorities and University for a period of six months as to be eligible for the award of the Diploma. The internship is partial fulfilment of the requirements for the completion and no candidate shall be declared to have completed the program otherwise. The internship shall be completed within 9 months of the date of passing final examination.

Students must undertake the rotational postings during which students have to work under supervision of an experienced staff in the following areas:

S. No.	Postings	Duration
1	Conventional Radiography (Fixed Radiography) Computed Radiography (CR)/Digital Radiography (DR) unit Mobile X-ray/Bedside radiography, Operation theatre radiography, Dental radiography	4 months
2	Fluoroscopy and other radiological procedures	2 months

Assessment of Internship

The intern shall maintain a record of work which is to be verified and certified by the faculty under whom he/she works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of the training. Based on the record of work and date of evaluation, the Head of the Institution/hospital will issue a certificate of satisfactory completion of training, following which the University will award the Diploma or declare him/her eligible for it.

Format for Training Report

Following is the suggestive format for the training report; actual format may differ slightly depending upon the nature of Institutes/Hospitals/Diagnostic Centers. The training report may contain the following

- Title page
- Certificate
- Acknowledgement
- Content Page with date and time start and end

Chapter 1. Organizational structure of Institutes/Hospitals/Diagnostic Centers and General Lay Out

Chapter 2. Types of major equipment/instruments/ machines used in Radiology with their specification and specific use and their routine maintenance.

Chapter 3. Equipment handling and procedures.

Chapter 4. Safety procedures followed

Chapter 5. Particulars of Practical Experiences in Radiology and Imaging

Chapter 6. Short report/description of the project (if any done during the training)

References /Bibliography.