Description of the specialized courses (compulsory, elective, and field training)

Course No.	Course name	Pre-requisite	Credit hours
0704101	Introduction to Medical Imaging	-	2
The student will be introduced to various aspects of the radiology program, including the history of radiation discovery, medical terminology, professional behavior, and ethics. Additionally, the clinic and imaging policies will be clarified, along with an overview of the formation and interactions of ionizing radiation. Finally, a summary will be provided of how the radiological image appears.			

Course No.	Course name	Pre-requisite	Credit hours
0704202	Medical Radiation Physics	-	3
The fundamentals of atomic and nuclear physics, as well as the characteristics of electromagnetic waves, are essential in understanding radiation production interactions. Additionally, the interaction of radiation with matter, including attenuation processes and coefficients for heterogeneous beams, plays a crucial role. The study of radioactivity and radiation, along with the principles of physics governing X-rays, further enhances our knowledge in this field. Moreover, nuclear radiation detectors are instrumental in detecting and measuring various forms of radiation.			

Course No.	Course name	Pre-requisite	Credit hours
0704211	Radiobiology and Radiation Protection	0704202	3
Characteristics and source of radiation, dosimetry measurements, natural radiation varieties, terrestrial radioactivity sources, immediate and delayed radiation effects, personnel monitoring, dosimetry concept, contamination assessment, minimizing radiation exposure, laboratory regulations on radiation, receiving radioactive substances, cell sensitivity to radiation, Physical and biological influences, direct and indirect radiation effects.			

Course No.	Course name	Pre-requisite	Credit hours
0704212	Computers in Radiologic Sciences	-	3
Diverse imaging techniques, fundamental physical principles, and the process of image creation, essential elements influencing image quality, conducting analyses on variables impacting image quality, fine-tuning the settings of the radiographic imaging system to generate a superior image through software, a range of detection systems, and the impact of artificial intelligence in radiology, presenting, disseminating, and compressing image storage and transmission, as well as outlining approaches linked to Picture Archiving and Communication Systems (PACS).			

Course No.	Course name	Pre-requisite	Credit hours
0704216	Principles of X-ray Equipment – Thr.	0704202	1
Production of X-rays, X-ray tubes, Generation and characteristics of X-rays, Absorption of gamma rays in biological tissues, Radiographic screens, Development of radiographic films, Breast imaging techniques, Real-time X-ray imaging, Quality of radiographic images, and Implementation of digital radiography.			

Course No.	Course name	Pre-requisite	Credit hours
0704224	Principles of X-ray Equipment – Pra.	0704202	2
Recognize X-ray films, file holders, components of the developing device, imaging equipment within the laboratory, and diverse X-ray parameters that influence image quality via the control panel, as well as recognize and utilize digital X-ray systems.			

Course No.	Course name	Pre-requisite	Credit hours
0704224	Radiographic Technique 1 – Thr.	0704216	1
Performing radiographic assessments of the upper and lower limbs, thorax (sternum), shoulder area, pelvic region, and sacroiliac joint involves adjusting patient positioning and radiation dosage based on the specific pathology or trauma, interpreting radiographic images to assess image quality, and accurately identifying anatomical structures.			

Course No.	Course name	Pre-requisite	Credit hours
0704225	Radiographic Technique 1 – Pra.	0704216	2
The proper alignment of the patient and their organs for both routine and additional projections, as well as the careful handling of equipment, meticulous selection of exposure factors and other parameters, and the finalization of the procedure through the exposure and processing of the film are all crucial aspects of patient positioning in radiography. To ensure the desired level of precision, any technical errors observed on the processed film should be rectified through thorough and repeated checks. The student undertaking this task is responsible for documenting their laboratory work in a logbook.			

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Course No.	Course name	Pre-requisite	Credit hours
0704227	Radiographic Technique 2 – Thr.	0704224	1
Performing radiographic assessments of the cranium, dentition, vertebral column, axial skeleton, facial structures, fundamental and supplementary projections, techniques for adjusting patient positioning, appropriate radiation dosage based on pathology and trauma, assessment of image clarity, and precise recognition of anatomical structures.			

Course No.	Course name	Pre-requisite	Credit hours
0704228	Radiographic Technique 2 – Pra.	0704224	2
The process of managing equipment, aligning patients and organs for regular and supplementary imaging, choosing suitable exposure factors and other variables, and finalizing the procedure through exposure and manipulation of developed film is crucial in radiography. In the event of any technical inaccuracies observed on the processed film, they will be rectified by conducting thorough and repeated checks for precision. Additionally, radiographic techniques are employed to visualize soft tissue structures without resorting to the utilization of contrast media, such as CT scans.			

Course No.	Course name	Pre-requisite	Credit hours
0704243	Patient care – Thr.	0701229	1
Patient care concepts, provision of information for patient care, the evolution of patient care systems over time, techniques and strategies for caring for patients undergoing radiography, pharmaceuticals and contrast agents used in the radiology department, scenarios necessitating the administration of drugs and contrast agents to patients, administration methods for medications and contrast agents in the radiology department, intravenous injection procedures for administering contrast agents and drugs to patients, and the impact of drug interactions on the human body.			

Course No.	Course name	Pre-requisite	Credit hours
0704244	Patient care – Pra.	0701229	2
By utilizing patient care techniques and approaches, healthcare professionals can effectively administer various radiological medications through different methods of injection.			

Course No.	Course name	Pre-requisite	Credit hours
0704335	Sectional Anatomy – Thr.	0704262	1
Gain a comprehensive understanding of gross anatomy, as well as the tomographic anatomy observed in advanced imaging techniques. Explore the tomographic anatomy of different regions of the human body from a three-dimensional perspective. Additionally, examine the gross anatomical structures depicted in CT, MRI, and ultrasound imaging plans across various imaging techniques.			

Course No.	Course name	Pre-requisite	Credit hours
0704336	Sectional Anatomy – Pra.	0704262	2
The brain, neck, chest, gastrointestinal tract, paranasal sinuses, male pelvis, female pelvis, spine, knee joint, and shoulder joint all have their unique sectional anatomy. By studying the sectional anatomy of these structures, healthcare professionals can gain a comprehensive understanding of their internal structures and relationships. This knowledge is crucial for accurate diagnosis, surgical planning, and treatment of various conditions and diseases affecting these anatomical regions. Understanding the sectional anatomy allows for precise localization of abnormalities and provides a foundation for effective medical interventions.			

Course No.	Course name	Pre-requisite	Credit hours
0704346	Radiographic Pathology – Pra.	0704364	3
Basics of General Pathology, Principles of General Pathology, Terms, and Definitions, Introduction to Radiation Pathology, Radiographic pathology of many systems in the human body (central nervous system, endocrine system, cardiovascular system, respiratory system, digestive system, biliary system, Urinary System, Reproductive System, Musculoskeletal System, Introduction to Artificial intelligence in Radiation Pathology, Patient Care for Disease.			

Course No.	Course name	Pre-requisite	Credit hours
0704353	Angiography Imaging – Thr.	0704227	1
The historical background of angiography, the procedure of conducting angiography, the various applications of angiography, the different modalities of angiography, visualization of the lymphatic system, the rationale behind examinations of blood vessels and the lymphatic system, potential drawbacks of angiography, pre-and post-procedural guidelines provided to patients at the radiology department, and the innovative three-dimensional imaging technology.			

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Course No.	Course name	Pre-requisite	Credit hours
0704354	Angiography Imaging – Pra.	0704227	2

Recognizing the equipment and instruments employed in visualizing and managing blood vessels, as well as examining radiographs to determine the causes of imaging during pathological circumstances. Also, identifying the devices and tools utilized for imaging and treating blood vessels, along with analyzing X-rays to ascertain the underlying reasons for imaging in pathological conditions.

Course No.	Course name	Pre-requisite	Credit hours
0704362	Principles of Ultrasound	0704202	2

Throughout history, there has been a continuous evolution of ultrasound devices. This progress can be traced back to the early days when there was a growing interest in the fundamental principles of physics and the development of diagnostic medical ultrasound devices. Researchers delved into the properties of sound waves and their intricate interaction with human tissue. Moreover, they extensively studied the concept of Doppler ultrasound and carefully examined the potential risks associated with its application.

Course No.	Course name	Pre-requisite	Credit hours
0704363	Magnetic Resonance Imaging 1	0704202	3

Fundamental scientific principles underlying magnetic resonance imaging (MRI) and the physics involved in the process. The essential structure of an MRI system, the various equipment components, and their roles encompass MR image generation, magnetization, signal relaxation time, slice orientations, spatial encoders, MRI contrast agents, and safety protocols. An analysis of the strengths and weaknesses of MRI in comparison to alternative imaging modalities.

Course No.	Course name	Pre-requisite	Credit hours
0704367	Computed Tomography 1	0704202	3

Learn about the physics and equipment of tomography, the basic elements of a computer system for tomography, the historical background and generations, the components of computerized tomography devices and equipment, the physical principles of the acquisition of computerized tomography data, image processing, display and storage, the definition of some mathematical calculations that depend on the work of the device. Computed tomography reconstruction and processing techniques and image quality, areas of use of tomography, advantages and limitations to its use, recent developments and applications in tomography, radiation protection, and dosimetry in computed tomography.

Course No.	Course name	Pre-requisite	Credit hours
0704375	Nuclear Medicine	0704202	3

Nuclear Medicine Principles, Basics, and Vocabulary, Models of Radioactive Decay, Production of Radionuclides and Radiopharmaceuticals, Analysis of Pulse Height, Challenges in Radiation Detection and Measurement, Systems for Counting, Fundamental Concepts of the Gamma Camera Device, Characteristics of Gamma Camera Performance, Quality of Images in Nuclear Medicine, Tomography Reconstruction in Nuclear Medicine, Single Photon Emission Computed Tomography, Positron Emission Tomography, Combined Imaging: SPECT/CT and PET/CT, Utilization of Digital Image Processing in Nuclear Medicine, Dosimetry of Internal Radiation, Physics of Radiation Health and Safety.

Course No.	Course name	Pre-requisite	Credit hours
0704376	Radiotherapy	0704202, 0704211	3

The idea of radiotherapy, its objectives, and its function, radiotherapy machines, internal radiotherapy (brachytherapy), treatment planning in external radiotherapy, and the measurement of radiation dosage. CT simulation device, linear accelerator, treatment planning, radiation dosage calculation, room for creating molds, cobalt 60 machine, brachytherapy, and its various uses.

Course No.	Course name	Pre-requisite	Credit hours
0704411	Quality Control in the Radiology Department	0704216	3

This course encompasses a comprehensive range of topics related to quality management in the field of radiology. It covers essential aspects such as health management, leadership, planning, motivation, and productivity within the radiology department. Additionally, it delves into the realms of medical ethics and organization, exploring the justifications for utilizing ionizing radiation and optimizing medical exposure doses. Furthermore, the course addresses the procurement process, authority levels, quality assurance, and selection control of radiology equipment.

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Course No.	Course name	Pre-requisite	Credit hours
0704441	Image Interpretation – Pra.	0704213, 0704332, 0704340	3

Fundamental understanding and proficiency in analyzing chest, abdominal, and skeletal radiographs, mammography, dual-energy X-ray absorptive scanning, laparoscopy, abdominal and pelvic ultrasound, nuclear medicine imaging of the heart, CT scans of the brain, and MRI images of the spine.

Course No.	Course name	Pre-requisite	Credit hours
0704460	Ultrasound imaging – Thr.	0704362	1

Medical terminology utilized in the realm of medical ultrasonography encompasses a wide array of concepts. The fundamental principles governing the clinical utilization of ultrasound in examining the cardiovascular system are of paramount importance. Additionally, the techniques employed in imaging the heart and blood vessels play a crucial role in diagnosing various conditions. Neonatal ultrasound, focusing on the spine and brain, is also a significant aspect of medical imaging. Furthermore, an introduction to musculoskeletal ultrasound aids in the identification of underlying disorders affecting the musculoskeletal system. The pathological manifestations of cardiovascular, neurological, and musculoskeletal disorders can be visualized through ultrasound imaging, providing valuable insights for medical professionals.

Course No.	Course name	Pre-requisite	Credit hours
0704461	Ultrasound imaging – Pra.	0704362	2

The utilization of medical ultrasound, along with the interpretation of scan charts, the provision of patient care, and the implementation of basic ergonomics are essential skills for a sonographer. Furthermore, ultrasound imaging and assessment of various anatomical structures such as the neck, chest, liver, gallbladder and biliary ducts, spleen, pancreas, kidneys, male pelvis, female pelvis, breast, scrotum, as well as obstetric ultrasound, are crucial components of the sonographer's role in the medical field.

Various echocardiographic scanning methods are utilized for ultrasound imaging and evaluation of different anatomical structures such as arteries and veins in various regions of the body including the neck, upper and lower limbs, abdomen, as well as the musculoskeletal system of both upper and lower limbs. Additionally, these techniques are also employed for examining the brain and spine of newborns.

Course No.	Course name	Pre-requisite	Credit hours
0704464	Magnetic Resonance Imaging 2 – Thr.	0704363	1

Sophisticated MRI methodologies, cutting-edge uses in MRI examinations for various anatomical regions, and pathological manifestations.

Course No.	Course name	Pre-requisite	Credit hours
0704465	Magnetic Resonance Imaging 2 – Pra.	0704363	2

Different techniques are employed in the field of MRI to study diffusion-weighted imaging in the brain and body, diffusion-tensioned imaging techniques, MRI spectroscopy techniques in the brain and body, as well as equipment demonstrations and experiments related to fMRI techniques.

Course No.	Course name	Pre-requisite	Credit hours
0704468	Computed Tomography 2 – Thr.	0704367	1

This course provides an overview of fundamental CT protocols for various anatomical regions, including the head, neck, chest, abdomen, pelvis, spine, upper and lower extremities, as well as CT interventional procedures. It covers essential aspects such as patient preparation, patient education, scan preparation, preferred orientation and positioning, imaging protocols encompassing scan parameters, scout image, slice thickness, SFOV, DFOV, windows, and method of reconstruction. Additionally, it discusses the use of contrast media, normal anatomy, the most common pathology encountered, and the associated collateral implications.

Course No.	Course name	Pre-requisite	Credit hours
0704469	Computed Tomography 2 – Pra.	0704367	2

Different imaging techniques are employed to examine various parts of the body. Computed tomography (CT) scans are commonly used to visualize the head and neck, including the orbits, temporal and facial bones, and paranasal sinuses. CT scans are also performed on the chest to assess the condition of the heart and the structures within the abdomen and pelvis. In the abdomen, CT scans can provide detailed images of the liver, pancreas, and colon, aiding in the diagnosis of digestive system disorders. Furthermore, CT scans are valuable in evaluating the urinary system, encompassing the kidneys, ureters, adrenal glands, and urinary system as a whole. Additionally, CT scans are utilized to examine the musculoskeletal system, including the spine (neck, back, and lumbar regions). Lastly, angiography, a specialized form of CT imaging, is employed to visualize the carotid arteries, coronary arteries, and pulmonary arteries.

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Course No.	Course name	Pre-requisite	Credit hours
0704491	Scientific Research Methodology	0701285	3

Definition of scientific research, the importance of scientific research, conditions of scientific research, standards and specifications of scientific research, foundations and elements of scientific research, characteristics of scientific research, motives of a researcher in scientific research, characteristics of a good researcher, types of scientific research, introductory papers in scientific research, the definition of research (introduction Research and its importance, research problem, research objectives, research hypotheses, research fields, defining terms), theoretical studies and previous studies, citation in scientific research, samples in practical research, scientific research methods and tools, main procedures in scientific research, foundations for preparing the research paper.

Course No.	Course name	Pre-requisite	Credit hours
0704493	Graduation Project in Radiology – Pra.	0704491	3

The research project is chosen by the student in one of the following areas: general X-rays and contrast media, computed tomography, magnetic resonance imaging, mammography, angiography, ultrasound, and nuclear medicine. The research project can also relate to medical physics, radiation protection, dosimetry, or radiotherapy planning topics.

Course No.	Course name	Pre-requisite	Credit hours
0704350	Mammography – Thr.	0704216	1

The examination of the structure of the breast and its associated organs, the recognition of the functional attributes of the breast, and the identification of certain breast-related illnesses along with their diagnostic techniques constitute the focus of studying breast anatomy.

Course No.	Course name	Pre-requisite	Credit hours
0704351	Mammography – Pra.	0704216	2

Features of the breast imaging apparatus and its operational theory, the rationale for patient imaging, techniques for patient imaging, protocols involved in this procedure, three-dimensional mammography, mammography technology, and quality assurance.

Course No.	Course name	Pre-requisite	Credit hours
0704356	Dental Imaging – Thr.	0704216	1

Principles of clinical application of cardiovascular (CV) ultrasound, Ultrasound and imaging techniques of the heart and vessels, Neonatal ultrasound (spine and brain), Introduction to musculoskeletal ultrasound, Pathological appearance of the heart and blood vessels, brain and spine of newborns childbirth, underlying musculoskeletal disorders in ultrasound images.

Course No.	Course name	Pre-requisite	Credit hours
0704357	Dental Imaging – Pra.	0704216	2

Echocardiographic scanning techniques, ultrasound imaging and assessment (arteries and veins of the neck inside and outside the skull, vessels of the upper limbs, vessels of the lower limbs, vessels of the abdomen, musculoskeletal system of the upper limb, musculoskeletal system of the lower limb, brain, and spine of newborns).

Course No.	Course name	Pre-requisite	Credit hours
0704444	Radiologic Administration	0701411	3

An ethical reasoning framework for addressing ethical and professional issues encountered in daily practice. Fundamental understanding of health services planning and management, including records, policies and procedures manuals, departmental planning and design, personnel management, leadership, staff supervision, and evaluation.

Course No.	Course name	Pre-requisite	Credit hours
0704450	Radiopharmaceuticals	0704211	3

Radiopharmaceuticals, radiopharmacy, methods for administering radioactive substances, labeling blood cells with radioactivity, clinical uses for radioisotope imaging, therapeutic radioisotopes.

Course No.	Course name	Pre-requisite	Credit hours
0704381	Radiography Clinical Practice 1	0704227	3

Radiographic tests will be conducted on the patient in the following manner:
Initially, students will spend a week in the radiology department as a whole. During this time, they will observe radiographic examinations. Working under the direct guidance of a senior radiologist, students will carry out radiographic tests on the upper and lower limbs, skull, thorax (rib cage), shoulder, pelvis, joints, sacroiliac joint, iliac bone, cranial bones, facial bones, thorax (lungs, heart), abdomen, and spine. Students will be motivated to actively participate in all radiographic procedures, identify errors in technique and processing, and propose corrective measures.

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Course No.	Course name	Pre-requisite	Credit hours
0704382	Radiography Clinical Practice 2	0704381	3
Radiology study areas and a dedicated mammography room will be assigned for student use. Students are required to conduct intravenous pyelography, CT scans, oral cholecystography, and mammograms under the guidance of experienced professionals. They will acquire practical skills in determining exposure factors for fluoroscopy, as well as providing support to patients and radiologists during barium studies of the gastrointestinal tract, hysterosalpingography, cystourethrography, and arthrography. Additionally, students will receive training on resuscitation equipment, and emergency medications, and will have the opportunity to practice general ultrasound procedures.			

Course No.	Course name	Pre-requisite	Credit hours
0704483	Radiography Clinical Practice 3	0704382	3
Throughout the duration of this course, students will be assigned specific rooms for their practical training. These rooms include the endoscopy room, the angiography room, and the catheterization laboratory. Under the expert supervision and guidance of a qualified radiologist, students will actively participate in various procedures such as lymphographic examinations, cardiac catheterizations, and interventional radiography. Additionally, students will also have the opportunity to work in the Department of Tomography, where they will be under the supervision of a qualified radiological technologist.			

Course No.	Course name	Pre-requisite	Credit hours
0704484	Radiography Clinical Practice 4	0704483	6
The emergency room utilizes various radiography techniques to cater to the specific requirements of accident and emergency patients. They conduct X-ray examinations for injured individuals and those who are critically ill. Additionally, they employ mobile radiography to perform X-ray examinations for patients in the intensive care unit, isolation room, patient room, and nursery, utilizing mobile X-ray equipment. In the operating room, a portable C-arm image intensifier is used for X-ray examinations of patients. Furthermore, the Department of MRI is also available for diagnostic purposes.			

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