SGT UNIVERSITY
SHREE GURU GOBIND SINGH TRICENTENARY UNIVERSITY
GURGAON, DELHI-NCR
(Established by the Haryana Act No.8 of 2013)
Faculty of Allied Health Sciences

M.Sc(RIT)
Syllabus

2017

Examination Scheme -Master of Science in Radio-Imaging Technology

1st Year

1st Semester								
Paper	Subjects	Paper code	Theory Examination		Practical Examination		Total Marks	Credits
			Uni. Exam	Internal Assessment	Uni. Exam	Internal Assessment		
1	Human Anatomy & Physiology		60	40	60	40	200	4+2
2	Pathology & Terminology		60	40			100	3
3	Image production & Evaluation		60	40	60	40	200	4+1
4	Radiation Physics & X-Ray Properties		60	40	60	40	200	4+1
5	Radiation Hazards, prevention and safety		60	40	60	40	200	4+1
			300	200	240	160	900	24
	2nd Semester							
	Subjects	Paper code	Theory Examination		Practical Examination		Total Marks	Credits
			Uni. Exam	Internal Exam	Uni. Exam	Internal Exam		
1	Research Methodology, Biostatistics & Hospital Management		60	40	-	-	100	3
2	Equipment Operation & Quality Control		60	40	-	-	100	3
3	Radiation Protection & Advance Diagnostics		60	40	60	40	200	4+1
4	Radio-Diagnosis & Radiographic Procedures		60	40	60	40	200	3+1
5	Nuclear Medicine & PET Training		60	40	60	40	200	4+2
			300	200	180	120	800	21
	2nd Year							
	3rd Semester							
	Subject	Paper code	Theory Examination		Practical Examination		Total Marks	Credits
			Uni. Exam	Internal Exam	Uni. Exam	Internal Exam		
1	Mammography, Ultrasound & Echocardiography		60	40	60	40	200	4+1
2	Special Investigations & Technology		60	40	60	40	200	4+2
3	Recent Advancements in Modern Imaging Technology		60	40	-	-	100	4
4	Patient care & Evaluation		60	40	-	-	100	4
	Dissertation (Submission of Synopsis/Plan & start of dissertation)		-	-	-	-	-	3*
			240	160	120	80	600	22
	4th Semester							
	Subject	Paper code	Theory Examination		Practical Examination		Total Marks	Credits
			Uni. Exam	Internal Exam	Uni. Exam	Internal Exam		
1	Computerized Tomography		60	40	60	40	200	4+1
2	Magnetic Resonance Imaging		60	40	60	40	200	4+1
3	Dissertation		-	-	150	50	200	15
			120	**80**	**270**	**130**	**600**	25

***The dissertation will be evaluated in the 4th semester and the credits be counted in the 4th semester while calculating the SGPA/CGPA**

M.Sc R.I.T- 1st Year

Semester -1

HUMAN ANATOMY & PHSIOLOGY

Total marks- 200 **Paper 1 (Part-A)** **Total Hours -30**

Topic	Teaching Guidelines	Domain	Hrs (30)
Introduction	Human body- Overview & Organization	Must Know	**1**
	Anatomical terminology.		
Cell	Cell morphology and diversity,	Must Know	**1**
	Introduction to the structure and function of cell organelles, Cell inclusions.		
3.Tissues	Macroscopic & microscopic studies of epithelial tissue,	Must Know	**2**
	Connective tissue, Bone,		
	Cartilaginous tissue, Muscle tissue,		
	Nervous tissue & The integument.	Desirable to know	
4.Skeletal Muscles	Major skeletal muscles of the Head, Neck, Thorax, Abdomen & upper and lower limbs.	Must Know	**1**
5.General Osteology	General morphology of bones,	Must Know	**2**
	Structural classification, Identification of individual bones of the skeleton,	Must Know	
	Development and growth of skeletal tissue and bones.	Nice to know	
6.General Arthrology	Naming, Identification, classification and application of classifications to the major joints of the human body	Must Know	**2**
7.Cardiovascular System	Anatomy of the adult & foetal heart &major arteries and veins; cellular components of blood.	Must Know	**1**
8.Lymphatic System	Anatomy of the lymphatic vascular structures, Lymph nodes.	Desirable to know	**1**
	Tonsils and other mucosa-associated lymphatic tissue, Spleen and thymus.	Nice to know	
9.Nervous System-	Anatomy of the brain & spinal cord,	Desirable to know	**1**
	The contents of the peripheral nervous system & autonomic nervous system.		
10. Respiratory system	Anatomy of the Respiratory System including the thoraco-abdominal diaphragm, epithelium of the respiratory tract and the lungs.	Must know	**2**
11. Digestive system	Anatomy of digestive organs - Mouth, Salivary glands, Pharynx, esophagus, stomach, intestine, liver, pancreas, biliary system & other abdominal organs in brief.	Must know	**2**
12.Urinary system	Anatomy of the kidneys, Ureters, Urinary bladder and the urethra.	Must Know	**1**
13.Endocrine System	Anatomy of Thyroid, Parathyroid, Suprarenal glands, Pineal gland and organs with a minor endocrine function, pancreas, Bulbourethral glands.	Nice to know	**1**
14.Male Reproductive System	Anatomy of the scrotum, Testes, Epididymis,Ductus deferens, Inguinal canal, Seminal vesicles, Prostate gland, Bulbourethral gland, penis & testis.	Desirable to know	**2**

15.Female Reproductive System	Anatomy of the ovaries, fallopian tubes, Uterus, Vagina and external genitalia; functions of ovary.	Desirable to Know	**1**
16.Special Senses	Anatomy of the contents of the Special Senses: Eye, Ear & skin.	Nice to know	**1**
17.Upper Limb	Detailed plain radiographic anatomy of skeletally mature and immature individuals, Regional and surface anatomy of the shoulder, axilla, and upper limb	Desirable to know	**2**
18.Lower Limb	Detailed plain radiographic anatomy, physiology of skeletally mature & immature individuals. Regional & surface anatomy of the hip, thigh, crus and pes	Desirable to know	**2**
19.Head and Neck	Surface anatomy, Major blood vessels & nerves of the head & neck.	Must know	2
	Regional anatomy of the brain: sectional anatomy of the head and neck	Desirable to know	
20.Cross sectional anatomy of body	Radiographic anatomy of different parts in various projections, Surface anatomy and applied anatomy pertaining to Radiology.	Must know	**2**

BOOKS REFERENCE:

A. Anatomy for Radiographers-C.A. Warrick
B. Gray's anatomy Descriptive and applied –T.B. Johnstor.
C. Foundation of Anatomy -Ross and Wilson
D. An Atlas of Normal Radiographic Anatomy-Richard & Alvin

M.Sc R.I.T- 1st Year

Semester -1

HUMAN ANATOMY & PHSIOLOGY

Total marks- 200 Paper 1 (Part-B) Total Hours -30

Topic	Teaching Guidelines	Domain	Hrs (30)
1.General Physiology	Structure of cell membrane.	Must Know	**3**
	Transport across cell membrane.	Desirable to know	
	Blood Propagation of nerve impulse, Muscle- properties-classification –excitation /contraction coupling.	Nice to know	
2.C.N.S. & P.N.S. - Receptor Physiology	Classification & properties of CNS & PNS	Desirable to know	**2**
	Reflexes-structure, properties& transmission.	Desirable to know	
	Physiology of Touch, Pain, Temperature & Perception	Nice to know	
	Physiology of Muscle Tone, Stretch, Physiology of Voluntary movement.	Desirable to know	
3.Excretory System	Kidneys: structure & function.	Must Know	**3**
	Maturation - neural control- neurogenic bladder,		
	Temperature Regulation, Circulation of the skin- body fluid-electrolyte balance	Nice to know	
4.Respiratory System	General organization, Mechanics of respiration, Anatomical &Physiological Dead space-ventilation/perfusion ratio,	Must Know	**3**
	Physiological changes with altitude & acclimatization	Desirable to know	
5.Cardio-Vascular System	Structure & properties of cardiac muscle.	Must Know	**3**
	Cardiac cycle, Heart rate regulation-factors affecting Heart Rate, BP: Definition, regulation, factors affecting BP, Cardiac output- Regulation & function affecting Cardiac output		
6.Lymphatic System	Physiology of the lymphatic vascular structures, Lymph nodes, their.	Nice to Know	**2**
	Tonsils and other mucosa-associated lymphatic tissue, Spleen and thymus.	Desirable to know	
7.Digestive System-	Physiology of the Mouth, Salivary glands, Pharynx, esophagus, stomach, intestine, liver pancreas, biliary system & peritoneal cavity, esophagus, stomach, small intestine, pancreas & liver.	Must Know	**3**
8.Endocrine System	Physiology of Thyroid, Parathyroid, Suprarenal glands, Pineal gland and organs with a minor endocrine function, Thyroid gland, Bulbourethral glands.	Nice to know	**3**
9.Male Reproductive System	Physiology of the scrotum, Testes, Epididymis,Ductus deferens, Inguinal canal, Seminal vesicles, Prostate gland, Bulbourethral gland, penis &testis.	Desirable to know	**2**
10.Female Reproductive System	Physiology of the ovaries, Uterine tubes, Uterus, Vagina and external genitalia; ovary.	Desirable to know	**2**
	Estrogen, Progesterone & Testosterone.	Nice to know	
11.Special Senses	Physiology of the contents of the Special Senses: Eye, Ear & skin.	Nice to know	**2**
12.Head and Neck	Surface physiology, Major blood vessels & nerves of the head & neck.	Must know	**2**
	Regional anatomy of the brain: sectional anatomy of the head and neck		

BOOKS REFERENCE:

A. Physiology for Radiographers-C.A. Warrick
B. Foundation Physiology-Ross and Wilson
C. Physiology for Radiographers-C.A. Warrick

M.Sc R.I.T
Semester -1
Paper 2

Total Marks- 100 **PATHOLOGY & TERMINOLOGY** **Total Hours -40**

Topic	Teaching Guidelines	Domain	Hrs (40)
1.Introductory Pathology	Cellular adaptation and cell death	Must Know	**18**
	Inflammation and repair; infection; circulatory disorders; immune defense		
	Genetics of disease: Neoplasia	Desirable to know	
	Cell injury and adaptation-Classification of tumors, Premalignant lesion	Desirable to know	
	Types of inflammation &system, manifestations of inflammation	Must know	
	Disorders of vascular flow & shock (Brief introduction) Infarction shock, Ischemia,Over hydration, Dehydration, Response to infection, Categories of infectious agents	Desirable to know	
	Host barriers to infection, How disease is caused, Inflammatory response to infectious agents,	Desirable to know	
	Hematopoietic and Lymphoid System-Hemorrhage, Various types of Anemia, Leucopenia, Leukocytosis Bleeding disorders, coagulation mechanism.	Nice to know	
2.Fundamentals of Medical Terminology	Word Roots, Prefix, Suffix, Abbreviations & Symbols:	Must Know	**12**
	Gastro intestinal		
	Respiratory		
	Circulatory		
	Renal		
	Nervous	Desirable to know	
	Reproductive	Must know	
3.Fundamentals of Medical Terminology-II	Common Diseases & Procedures:	Must Know	**10**
	Gastro intestinal- Obstruction, Carcinoma, indigestion etc		
	Respiratory- Tuberculosis, Pleural effusion, consolidation etc		
	Circulatory- Thrombosis, embolism, blockage, narrowing etc.		
	Nervous- Motor disease and brain functional disease	Desirable to know	
	Reproductive- Fallopian tubal Tuberculosis, blockage, congenital disease etc.	Must know	
	Oncology- Introduction and related terms	Nice to know	

BOOKS REFERENCE:

A. Robbins Basic Pathology
B. Robbins and Cotran Pathologic
C. Basis of Disease Medical Terminology for Health Professions

M.Sc R.I.T
Semester -1
Paper 3
IMAGE PRODUCTION & EVALUATION

Total Marks – 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1. **Photographic Process**	Radiographic film- Image processing	Must Know	15
	Manual as well as automatic, Sensitometer, Intensifying screens, Film/screen combinations/analyzing the image		
	Establishing image standards- Professional imaging standards, The analytical process, Acceptance limits		
	Radiographic Quality- Density: contrast, Recorded detail, distortion	Desirable to know	
	The art of films critique- Implementing imaging standers, Identifying an image problem.	Nice to know	
2.Quality Management	Quality assurance and quality control	Must Know	10
	Comparing exposure systems		
	Developing exposure charts		
	Fixed kilovoltage system, Variable kilovoltage system	Desirable to know	
	Other exposure systems- Automatic exposure controls	Must know	
3.Exposure conversion problems:	Planning of a processing room as well as of a radiology department	Must Know	7
	Day light processing system Image recording devices- Video recorder, Multi format camera, Laser camera, Dry camera etc.		
	Photo fluoroscopy Special imaging processes- Copying, radiography, Xero-radiography, Subtraction technique	Desirable to know	
4.Factors affecting recorded detail:	Density, Distortion and contrast.	Must Know	**7**
	Relationship among density, distortion, contrast, and recorded detail		
	Factors that govern the selection of films, screens and grids.		
	Relationship between films and screens.	Desirable to know	
	Effect of factors influencing exposure control, Exposure calculations for various radiographic procedures.	Nice to know	
	Advantages and disadvantage associated with automatic exposure control.	Desirable to know	
5.Factor affecting the decision to use automatic exposure controls:	Simulated radiographic procedure, Use, Technique, Charts to select exposure factors, Film storage Considerations.	Must Know	**11**
	Radiographic identification procedures. Periodic maintenance for automatic film processors	Must Know	
	Procedures for loading and unloading. Computed radiography systems.	Must know	

BOOKS REFERENCE:

A. Mosby's Comprehensive Review of Radiography

M.Sc R.I.T
Semester -1
Paper 4

Total Marks- 200 **Radiation Physics** **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1.General Physics	Electrical charges, potential difference, current and resistance.	Must Know	6
	Ohms Law for electrical circuit, direct current, alternating current, conductors, semiconductors, insulators, power, ammeter and voltmeter.		
	Electromagnetism, Electromagnetic Induction: Self and Mutual, Capacitor, capacitance.	Desirable to know	
2.Electric system, Components and Control in X-Ray Circuit	Electric supply & Distribution; diagnostic X-Ray circuits- X-Ray Tube, Transformers, types of transformers, losses.	Must Know	8
	The Tube Stand and Control of panel: Rectification; diodes and rectifiers, semiconductors, Incoming light circuits (Phases – Single & Triple Phase modes, Three Phase 6-pulse mode, Three phase 12- pulse mode; Specialized X-Ray Generators & Transformers.	Must know	
	Basic X-Ray circuits transformers laws and types used in X-Ray machine. The rectification of high tension, control of kilovoltage, filament circuit and tube current	Desirable to know	
3.Exposure switches and Timer / AEC	Exposure switches and relays timers and its radiographic application. Beam limiting devices, Absorption co-efficient, grids, cones and filter.	Must Know	8
	Electronic Timers; Automatic Exposure Control Timers, Phototimer	Desirable to know	
4.X-Ray Tubes	Fixed and rotating anode, faults in X-Ray tubes,	Must Know	12
	Grid Controlled X-Ray Tube,		
	Mammography X-Ray Tube,		
	Heavy Duty X-Ray Tube,		
	Micro-Focus X-Ray Tube		
	Tube Rating and Tube Support- Tube heat Ratings,	Desirable to know	
	Line Focus principle,	Must Know	
	Anode Cooling chart,	Desirable to know	
	Type of X-Ray Tube Stands.		
	Tube overload indication, X-Ray Tube over Load Protection Circuits	Nice to know	
5.Image Intensifier	Fluoroscopic equipment,	Must Know	8
	Digital Fluoroscopic,		
	Dental radiographic equipment,		
	Portable and Non- Portable equipments		
6.Care and maintenance	Maintenance and care of all X-Ray equipment and accessories.	Must Know	8

Practical

1) X-Ray tubes and accessories, general features.
2) Portable X-Ray Equipment.
3) Image intensifier, its features, spot film.
4) Radiation protection devices
5) Effects of kV and mAs.
6) Maintenance of X-ray equipment and accessories.
7) Mammography X-Ray tube
8) Dental X-Ray unit.

BOOKS REFERENCE: Textbook of Radiology /Radiation Physics by Thomas S. Curry

M.Sc R.I.T
Semester -1
Paper 5
RADIATION HAZARDS, PREVENTION & SAFETY

Total Marks- 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1.Radiation Protection Principles	History & development-National & international agencies, AERB, BARC, ICRP, WHO,IAEA and their role Equivalent dose, effective dose Sources of radiation-natural& man made	Must Know	**8**
2.Biological effects of Radiation	Effects on cell-stochastic & deterministic effects-radiation risk-tissues at risk-genetic, Somatic & fetus risk-risk Dose equivalent limits-Philosophy-ICRP (60) Concepts-AERB guidelines.	Must Know	**8**
3.Planning of Radiation Installation	Protection from primary, leakage/scattered radiation, Workload-Use factor, Occupancy factor & distance. Primary & secondary barrier design calculations, Design of doors, Control of radiation-Effects of time, Distance and shielding, Barrier design- Barrier materials	Must Know	**8**
4.Personnel Monitoring Systems	Principle and objective-film badge-guidelines for use-Thermo luminescent dosimeter, Badge-pocket dosimeter Area monitoring and radiation survey- Practical use of survey meter, Zone monitors and phantoms, Survey in x-ray, fluoroscopy and CT scan units.	Must Know	**8**
5.AERB safety code and ethics	Built in safety specification for diagnostic x-ray, Fluoroscopy and CT units Specification for radiation protection devices-room layout Operational safety-Radiation protection programme-Personnel requirements and responsibilities-regulatory controls	Must Know	**8**
6.Patient Protection	Safe work practice in diagnostic radiology-Radiation absorbed dose from general dental fluoroscopy, X-ray and CT examinations, X-ray examinations during pregnancy, medico-legal or insurance purpose, Medical research Avoidance of unnecessary radiation dose	Must Know	**6**
7.Radiation Emergencies	Situation preparedness, safety and prevention-legal requirements Recent developments in radiation safety related topics	Desirable to know	**4**

BOOKS REFERENCE:

A. Radiation Protection in Hospital. Richard F. Mould
B. Basic radiological physics, Jaypee bothers pvt. Ltd New Delhi
C. An Introduction to Radiation Protection Allen Martin "& Samuel
D. Radiation safety in Medical practice. M.M. Rechami

M.Sc R.I.T
Semester -2
Paper 1

RESEARCH METHODOLOGY, BIOSTATICS AND HOSPITAL MANAGEMENT

Total Marks- 100 **Total Hours- 40**

Topic	Teaching Guidelines	Domain	Hours (40)
1.Introduction research methodology	Introduction to research methods,	**Must know**	6
	Variable in research		
	Reliability and validity in research		
	Conducting a literature review		
	Formulation of research problems and writing research questions		
	Hypothesis, Null and research Hypothesis, Type I and type	**Desirable to know**	
	II errors in Hypothesis testing		
2.Data collection	Experimental and non experimental research designs,	**Must Know**	3
	Sampling methods, data collection, observation method,		
	Interview method, questionnaires and schedules construction		
3.Research Frame work	Ethical issues in research Principles and concepts in research ethics-confidentiality and privacy informed consent Writing research proposals Development of conceptual framework in research	**Desirable to know**	3
4.Introduction to statistics	Introduction to statistics	**Must Know**	3
	Classification of data, source of data,		
	Method of scaling- nominal, ordinal, ratio and interval scale	**Nice to know**	
	Measuring reliability and validity of scales		
5.Data sampling	Measures of central tendency,	**Must Know**	6
	Measures of dispersion, skewness and kurtosis, sampling, sample size determination.		
	Concept of probability and probality distributions- binomial probability distribution, poison probability distribution and normal probability distribution	**Desirable to know**	
6.Data correlation	Correlation-Karl person, spearman's rank correlation methods regression analysis, testing hypothesis-chi square test, student's test, NOVA	**Desirable to know**	3
7.Health care – an overview	Functions of Hospital administration	**Must Know**	8
	Modern techniques in Hospital management		
	Challenges and strategies of Hospital management		
	Administrative Functions– Planning, Organizing, Staffing, Leading and Controlling Organizational Structure, Motivation and leadership. Designing health care organization.	**Must Know**	
8.Hospital Management	Medical record, House-keeping services	**Must Know**	8
	Laboratory performance.		
	Management of biomedical waste.		
	Total patient care – indoor and outdoor.		
	Nursing and ambulance resources.	**Desirable to know**	
	Evaluation of hospital services.		
	Quality assurance. Record reviews and medical audit.	**Nice to know**	

BOOKS REFERENCE:

Methods in Bio-Statistics for medical students, Mahajan, B.K., Jaypee Brothers MedicalPublishers, New Delhi.

M.Sc R.I.T
Semester -2
Paper 2
EQUIPMENT OPERATION AND QUALITY CONTROL

Total Marks- 100 **Total Hours- 40**

Topic	Teaching Guidelines	Domain	Hrs (40)
1.Various Radiographic equipment and accessories	Component parts labelling	Must Know	**16**
	Equipments used for Sonography, Computed radiography, CT,MRI & digital radiography		
	Differences in various types and models of portable radiographic equipment		
	Differences in portable and non-portable radiographic equipment.		
2.X-Ray Tube:	Theory of operation of an X-ray tube, Construction and function of an X-ray tube	Must Know	**12**
	Determine the maximum allowable exposure factor for various radiographic procedures using an X-ray tube rating chart		
	Simulations of radiographic exposures and anode and tube housing cooling charts	Desirable to know	
	Determine the rate of anode and tube housing cooling X-ray tube warm-up procedures for radiographic equipment from various manufactures.	Nice to know	
3.Safety checks of radiographic equipment:	Safety checks of radiographic equipment and accessories such as lead aprons and gloves and collimator accuracy	Must Know	**14**
	Identify symptoms of malfunctions in radiographic equipment	Desirable to know	
	Procedures for malfunctions of radiographic equipment Detailed of Sonography CT scan & MRI	Nice to know	

BOOKS REFERENCE:

A. Essentials of Radiologic Science Workbook Robert A. Fosbinder
B. Textbook of Radiographic Positioning and Related operation and quality control

M.Sc R.I.T
Semester -2
Paper 3
RADIATION PROTECTION & ADVANCED DIAGNOSTIC TECHNIQUES

Total Marks- 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs(50)
1.Beam Restricting Devices	Describe the use and function of beam limiting devices	Must Know	**12**
	Beam filtration and shielding devices		
	Relationship between exposure factors and patient dosage		
	Nature and function of the ten-day rule		
	Screen and exposure setting combination that will minimize the radiation dosage that patients receive.	Desirable to know	
2.Radiographic Procedures	Methods to avoid repeat radiographs	Must Know	**12**
	Purpose of primary and secondary radiation barriers and room construction and Design in terms of personnel protection		
	Radio diagnosis & radiographic equipments and techniques used to reduce personnel exposure during radiographic		
	Fluoroscopic, mobile, and surgical procedures.	Desirable to know	
3.Radiographic Devices	Types and purposes of personnel protective devices used during radiographic, fluoroscopic, mobile, and surgical procedures	Must Know	10
	Types, uses, and purpose of patient restraint devices for reducing personnel radiation exposure		
	Personnel monitoring devices in terms of purposes, types, characteristics, advantages and disadvantage.		
4.Introduction to computer	History and development of computer	Must Know	**6**
	Basics storage and transfer of data- operation of computer,		
	Performance of computer systems		
	Computer software and hardware		
	Storage acquisition processing and display of digital images- Care and preventive maintenance of the computer system.	Desirable to know	
5.Computed Tomography and Magnetic resonance imaging	Basic principle, data accumulation-image reconstruction, Storage of image, Viewing the image,	Must Know	**6**
	Evaluation of image,		
	Image quality, Artefacts & corrective measures Safety considerations		
6.Digital Radiographic Imaging	History and development	Must Know	**4**
	Theory and Principle		
	Digital fluoroscopy system-digitized image-digital, subtraction techniques-digital image processing-future equipment developments- Clinical application	Must know	
	PACS (Picture Archival and Communication System),		
	Digital Image and image quality:- Laser film printers		

Practical-
C.T. Guide procedures
Fine needle aspiration cytology
Fine needle aspiration Biopsy
Stereo tactic biopsy- Radio surgery
Ultrasound Guided Procedures-
Fine needle aspiration Cytology
Fine needle aspiration Biopsy
Fluoroscopy guided procedure
Endoscopic Retrograde Choledocho Pancreatography
Percutaneous
Nephrolithotomy- Percutaneous
Nephrostomy, Percutaneous transhepatic biliary drainage, Angioplasty- Embolisation-
Transjugular liver biopsy.

BOOKS REFERENCE:
A. Fundamentals of Diagnostic Radiology William E. Brant, Clyde A. Helms

M.Sc R.I.T
Semester -2
Paper 4
RADIO DIAGNOSIS & RADIOGRAPHIC PROCEDURES

Total Marks- 200 Total Hours- 40

Topic	Teaching Guidelines	Domain	Hrs (40)
1.Positioning Terminology	Types and functions of immobilization and positioning devices,	Must Know	**10**
	Radiographic procedure, Appropriate breathing instruction for patient		
	Positioning and technique variations for various radiographic procedures		
	Procedures for patient preparation		
2.Types of Contrast Media:	Contrast media with radiographic procedures	Must Know	**16**
	Specific contract medium Indications, Contraindications and the adverse reactions associated with its use.		
	Routine and special radiographic procedures		
	Steps for patient preparation and patient positioning Routine and special radiographic procedures		
	Equipments needed and the exposure setting that are consistent with A.R.R.T. specifications.		
3.Different Radiographic Procedures:	Learning & system of Sonography	Must Know	**14**
	Different means of Sonography and diagnostic procedures Learning regarding advancement and new technology in the field of radio diagnosis		
	Learning regarding CT scan, complete functioning		
	CT scan a way of diagnostic procedures		
	Learning in MRI		
	Techniques and its usefulness in different diagnostic procedures		
	Learning of different aspects of digital radiology, CR System and DSA.		

Practical

RADIO IMAGING & DIAGNOSIS–I

Radiographic positioning of various parts

Immobilization technique in pediatrics radiography

Selection of contrast media & its application

Its indication and contraindication, management of reaction/ side effects

Application of conventional radiography , USG, CT & MRI techniques

Systematised use of CR ,DR,DSA etc.

ADDITIONAL READINGS:

A. A Guide to Radiological Procedures by Stephen Chapman

M.Sc R.I.T
Semester -2
Paper 5
NUCLEAR MEDICINE & PET TRAINING

Total Marks- 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1.Nuclear Medicine	Applications and Apparatus for nuclear medicine	Must Know	4
2.Gamma Camera	Application, Function and instrumentation	Must Know	6
3.SPECT & PETCT	Definition, Applications, Clinical uses, advantages & disadvantages	Must Know	8
4.Radionuclides	Characteristics and half-life of Radionuclides. Commonly used Radionuclides	Desirable to Know	6
5.Indication, contraindications of PET Scans.	Indication and contraindications of PET	Must Know	6
6.Patient Preparation	Patient preparation technique in PET Scan.	Must Know	6
7.NMI	Radionuclide scanning including thyroid up takes measurement	Desirable to Know	14
	Rectilinear scanner	Nice to know	
	Gamma camera, PET,SPECT-their principles working applications and advancements	Nice to know	

M.Sc R.I.T -2nd Year

Semester -3

Paper 1

MAMMOGRAPHY, ULTRASOUND &ECHOCARDIOGRAPHY

Total Marks- 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1.Mammography	Dedicated mammographic unit and its special features,	Must Know	10
	Mammographic Positioning and technical considerations,		
	Film screen mammography, digital mammography		
2.Ultrasound	Principle & history of Ultrasound, advantages and disadvantages of ultrasound, Types of Ultrasound, Equipment description,	Must Know	10
	Indication and Clinical Application,		
	Physics of ultrasound imaging,		
	Physics of transducers,		
	Physics of Doppler,		
	Ultrasound tissue characterization, Potential for three dimensional ultrasound,		
	Artifacts in ultrasound,	Desirable to know	
	Comparison of ultrasound equipment Computerization of data, Image recording, Ultrasound jelly & Safety of ultrasound.	Desirable to know	
3.Abdomen and pelvis ultrasound	Pathologies and indications, patient preparation,positioning and scanning technique.	Must Know	4
4.Neck	Pathologies and indications, patient preparation, positioning and scanningtechnique.		2
5.Orbit	Pathologies and indications, patient preparation, positioning and scanningtechnique.		2
6.Submandibular gland	Pathologies and indications, patient preparation, positioning andscanning technique.		2
7.Thorax	Pathologies and indications, patient preparation, positioning and scanningtechnique		2
8.Breast	Pathologies and indications, patient preparation, positioning and scanningtechnique.		2
9.Scrotum	Pathologies and indications, patient preparation, positioning and scanningtechnique		2

10.Color Doppler imaging. The obstetric Ultrasound examination	Method of gynecologic ultrasound examination,Assessment of Normal fetal growth, fetal behavior states, fetal breathing movements, fetal cardiac activity.	Desirable to know	4
11.USG Contrast Media	Types of Ultrasound Contrast media and its advantages	Must Know	4
12.Echocardiography:	Introduction, indication and image formation. Uses of color Doppler in echocardiography and equipment description with transducer.	Must Know	6

M.Sc R.I.T
Semester -3
Paper 2
SPECIAL INVESTIGATION & TECHNOLOGY

Total Marks- 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domian	Hrs (50)
1.Special Investigation	Soft tissue radiography**,** High KV techniques**,** Macro Radiography**,** Mammography	Must Know	6
	Foreign body localization.		
2.Types of Radiography	Operation theater radiography, Trauma and ward radiography-Pediatric radiography	Must Know	12
	Special procedures: HSG, Myelography, Orthography, DCG		
3. **Interventional procedures**	PTC, ERCP, PCN and FNAC: Fluoroscopy/ US/CT guided.	Must Know	8
	Angiographic procedures Vascular/non –vascular		
	MRI-Various imaging protocols and techniques Digital imaging , applications and advancements		
4. **Use and function of beam limiting device**	Beam filtration, and shielding devices.	Must Know	8
	Relationship between exposure factors and patient dosage		
	Nature and function of the ten-day rule		
	Screen and exposure setting combination that will minimize the radiation dosage that patients receive.		
5.Methods to avoid repeat radiographs	Purpose of primary and secondary radiation barriers	Must Know	8
	Room construction and design in terms of personnel protection	Desirable to know	
	Radio diagnosis, Radiographic equipments and techniques used to reduce personnel exposure during radiographic, fluoroscopic, mobile, and surgical procedures		
6. **Types and purposes of personnel protective devices:**	Types and purposes of personnel protective devices used during radiographic, fluoroscopic, mobile, and surgical procedures	Must Know	8
	Types, uses, and purpose of patient restraint devices for reducing personnel radiation exposure Personnel monitoring devices in terms of purposes, types, characteristics, advantages, and disadvantage.		

BOOKS REFERENCE:

A. Introduction to the Principles of Medical Imaging Chris Guy , Dominic Fitches

M.Sc R.I.T
Semester -3
Paper 3

RECENT ADVANCEMENTS IN MODERN IMAGINGTECHNOLOGY

Total Marks- 100 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1.Special Techniques	Special Techniques of the following- Radiographic techniques of whole upper limb & shoulder girdle	Must Know	**10**
	Radiographic techniques of whole lower limb and pelvic girdle		
	Radiographic techniques of whole vertebral column, skull, cranial bones and facial bones		
	Dental radiography, Intra oral, Extra-oral as well as ocular radiograph	Desirable to know	
2.Radiographic Technique:	Radiographic technique of whole thorax including Lungs,	Must Know	**10**
	Meditational, Heart, Ribs, Diaphragms		
	Special Procedure For Liver, Pancreas, Spleen, Biliary system, GI tract and Genitourinary tract		
	Radiographic techniques for Obstetrics and Gynecology studies,	Desirable to know	
	Radiographic techniques for cardio-vascular system		
	Radiographic techniques for lymphatic system	Nice to know	
3.Recent Advances:	Recent advances in Ultrasound, Probe designing, High frequency probes and contrast sonography	Must Know	**6**
4.Recent Advances in CT	Recent advances in CT, MDCT, Multi tube CT, Electron beam CT and latest detector systems	Must Know	**8**
5.Recent Advances in MRI	Recent advances in MRI, newer sequences, MRS, functional MRI and Cardiac MRI	Must Know	**8**
6.Recent Advances	Recent advances in PET-CT, newer isotopes other than FDG,PET MRI	Must Know	8

BOOKS REFERENCE:

A. Introduction to the Principles of Medical Imaging Chris Guy , Dominic Ffytche

M.Sc R.I.T
Semester -3
Paper 4
PATIENT CARE & EVALUATION

Total Marks- 100 **Total Hours - 40**

Topic	**Teaching Guidelines**	**Domain**	**Hrs (40)**
1.Patient Care	Principles of body mechanics applicable to patient care Procedures for patient transfer	Must Know	**10**
	Procedures for turning patients who have severe trauma, Unconsciousness, Disorientation, or Amputated limbs Patient preparation stamps.		
2.Radiographic Procedures	Radiographic procedures using contrast agents Appropriate contrast agent for each procedure	Must Know	**30**
	Patient preparation in terms of procedures, Indications, contraindications and symptoms of treatment for adverse reactions to contrast agents		
	Disinfection and sterilization procedures		
	Procedures for scrubbing, Donning gowns and gloves, Removing gowns and gloves, and handling sterile instruments	Desirable to know	
	Procedures for handling and disposing of infectious wastes Isolation techniques	Nice to know	
3.Management of infectious patients	Psychological considerations for the management of infectious patients	Must Know	**20**
	Vital signs used to assess patient condition, measurements of Vital signs		
	Clinical measurement and recording of temperature, pulse, blood pressure and respiration.		
	Symptoms of cardiac arrest, anaphylactic shock, convulsion, seizure, hemorrhage, apnea, emesis, aspiration, fractures and diabetic coma/insulin reaction		
	Acute care procedures for cardiac arrest, Anaphylactic shock, Convulsion, Seizure		
	Hemorrhage, Apnea, Emesis, Aspiration, Fractures, diabetic coma/insulin reaction	Desirable to know	
	Use of medical equipment and supplies in treating medical emergencies.	Nice to know	

BOOKS REFERENCE:

A. Principles and Techniques of Patient Care
B. Pierson and Fairchild's Principles & Techniques of Patient Care

Note- Third Semester Included with Submission of Synopsis

M.Sc R.I.T
Semester -4
Paper 1
COMPUTERIZED TOMOGRAPHY

Total Marks- 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1.Measures to Control Scatter Radiation:	Recent developments in x-ray tube technology	Must Know	**14**
	Advancements in H.T. generators		
	Measure to control scatter radiation including-		
	Beam centering devices		
	Collimator cone diaphragms and grids		
	Fluoroscopy and IITV systems- Cine radiography with various recording devices		
	Tomography principles, various types and its applications	Desirable to know	
2.Computed Tomography:	Principle, Data acquisition, Concepts, Image reconstruction, Instrumentation, Image manipulation	Must Know	**12**
	Historical developments-Various generators, Spiral/helical, Single slice		
	Multi slice CT, Electron beam CT, Mobile CT, Advance volume scanning, Continuous sub second scanning, Real time CT Fluoroscopy Interventional guidance tool 3D CT Angiography	Desirable to know	
	Virtual reality imaging Including image quality and quality control in CT scanners	Nice to know	
	Computer Tomography Various imaging protocols and technique Post processing and making CT Films with MIP, MPR, VR, 3D techniques etc.	Desirable to know	
3.Special procedures	CT Angiography Procedure- Brain, Neck, Brain + Neck, Pulmonary, Cardiac angio with respiratory gatting, Liver Triple phase, Renal angio, Upper Limb and Lower Limb Angio,	Must Know	8
	Virtual Colonoscopy, Virtual Endoscopy, Virtual Bronchoscopy etc.	Nice to know	
4.CT Interventional Procedures	CT Guided FNAC, Biopsy, Tapping.	Must Know	8
5.CT Artefacts	All types CT Artefacts and its corrective measures.	Must Know	8

BOOKS REFERENCE:

A. Fundamentals of Diagnostic Radiology William E. Brant, Clyde A. Helms

M.Sc R.I.T
Semester -4
Paper 2
MAGNETIC RESONANCE IMAGING

Total Marks- 200 **Total Hours- 50**

Topic	Teaching Guidelines	Domain	Hrs (50)
1.MRI Basic& Hardware	History of MRI	Must Know	**8**
	Types of Magnets and Use in MRI		
	Basic principles of MRI Complete imaging equipment and various requirements,		
	Instrumentation of MRI		
	Principles of MRI		
2.MRI Physics	T1 and T2 Relaxation, Behaviors of tissues T1T2 and proton density images, Spiral localization of images. K-Space and its filling, Image reconstruction in MRI	Must Know	**6**
3.MRI Sequences & Parameters	Types of imaging sequences (Spin echo, fast spin echo, flash, Inversion recovery, gradient echo etc.).	Must Know	**6**
	TR, TE, Flip Angle, Inversion Time, NEX, Matrix, FOV, Slice Thickness, Slice Gap, Bandwidth.		
4.MRI Coils	Transmitted coils, receiver coils, transmit and receive coils, gradient coils.	Must Know	**6**
5.MRI Artefacts	All types of artefacts in MRI and its corrective measures.	Must Know	**6**
6.MRI Special Procedures & Sequences	MR Angiography sequences TOF- 2D and 3D, Phase contrast,	Must Know	**8**
	MRI Angiography and CEMRI Angiography,	Desirable to know	
	MRI Venography,		
	MRI Urography, MRCP, MRI guided Procedures		
	MR spectroscopy, principles and techniques,	Must know	
	DWI, Diffusion Tensor,	Nice to know	
	Functional MRI and BOLD sequences.	Nice to know	
7.MRI Hazard and Safety	Planning of MRI Equipment installing in department,	Must Know	**2**
	MRI Hazard and Safety,		
	Indication and contraindications of MRI		
8.MRI Contrast Media	Types of MRI contrast media- Positive and negative,	Must Know	**8**
	Its dose and indication and contraindications of MRI contrast.		

BOOKS REFERENCE:

A. Introduction to the Principles of Medical Imaging Chris Guy , Dominic Fitches

M.Sc R.I.T
Semester -4
Paper 3

Total Marks – 200

Submission of Dissertation

The research project is to be carried out over a period of approximately 6 months and will be carried out in the hospitals, subject to approval by all concerned. Each student will select research project with their respective supervisors. The projects will be selected such that a student can reasonably be expected to make an original contribution to the chosen area of research within the time period allotted. The purpose of the project is to provide the student with training in academic research and acquisition of practical skills, including the design of a research project, planning of experiments, dealing with practical problems, recording of, presenting and analyzing data.

Unit I- Thesis Proposal Development is an independent tutorial conducted by the student's advisor, and involves a comprehensive literature survey of the chosen research area. Through regular meetings, the student and advisor discuss this literature in detail and the topic for research project will be finalized in the third semester.

Unit II- Thesis proposal Each student must submit to the university with the signed approval of the advisor, a thesis proposal defining the thesis project, the methods and design of the experiments needed for completion, the progress to date and plans for completion in the third semester.

Unit III – Thesis preparation: This is involving preparation of the thesis. The thesis must include a cover page, abstract, table of contents, introduction of the thesis topic with a comprehensive review of literature, appropriately organized methods, results and discussion section for the experiment performed and final conclusions section summarizing the outcome of the project. The student should submit a draft of the thesis to the advisor by the end of the fourth semester.