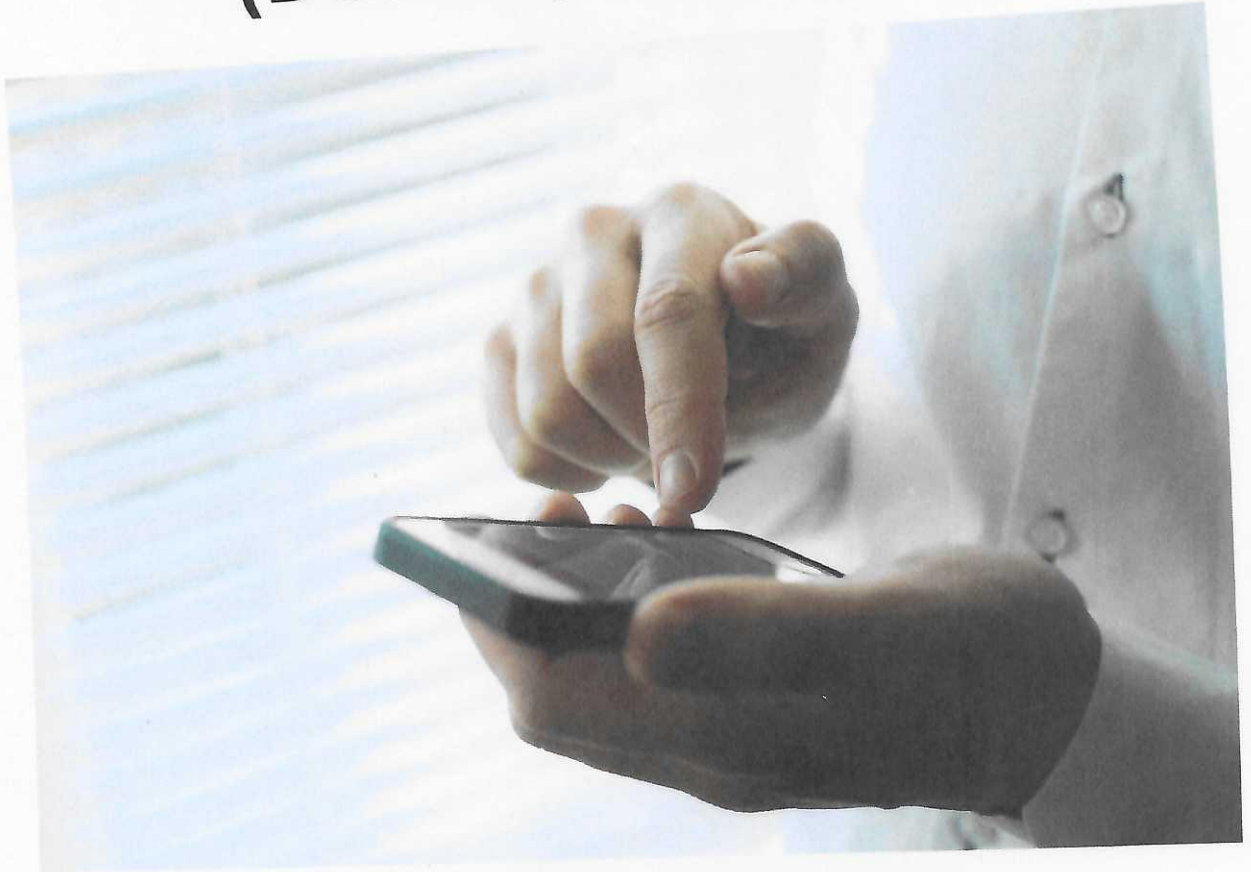


Syllabus for Bachelor of Science Medical Imaging Technology (B Sc MIT) Programme



Guru Gobind Singh Indraprastha University

A State University established by the Govt. of NCT of Delhi

University School of Medicine and Allied Health Sciences

SCHEME OF EXAMINATION

&

SYLLABI

for

**Bachelor of Science (Medical Imaging Technology)
(B.Sc.(MIT))**

Offered by

**University School of Medicine and Para-Medical
Health Sciences**

1ST Year TO 3RD Year



**GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY**

**Guru Gobind Singh Indraprastha University
Sector 16C, Dwarka, Delhi – 110 078 [INDIA]
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*Latest
put given by
Prof. Vaidya
Agarwal,
Dean, on
15/7/21
to put the
same in this
file*

15/9/21

Bachelor of Science (Medical Imaging Technology) or B.Sc. (Medical Imaging Technology) is an undergraduate (UG) level course program which introduces students to the fundamentals of imaging technology. It is a 3 years course program. An academic year for the period of 12 months. The minimum duration is 3 years and the maximum duration is 5 years.

The program is a new program which is still establishing itself. The program is a branch of Medical Research and Development, related to the study of several techniques of taking images of human body parts for medical use as well as research purposes. The course main aim is a diversified plan of study in advance imaging like MRI and CT scan, healthcare management and general knowledge about the discipline.

BSc in Medical Imaging Technology program is appropriate for aspirants who are looking to expand their skills and study a career field related to medical research sciences and development and technological research sciences in companies that lead to a breakthrough in diagnostic medical imaging.

For the purpose of teaching, each year shall be partitioned in two part (of six months each). Papers offered in a year, as a two part paper shall be taught sequentially (one in the first part of the academic year and the Part 2 in the second part of the academic year).

The yearwise distribution of papers is as presented from next page.

GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, DELHI
Bachelor of Science (Medical Imaging Technology)

First Year

Code	Paper Name	L	P	Marks Distribution		
				TCE	TEE	MM
Theory						
BMIT101	Radiological Physics (Part-1)	50		25	75	100
BMIT102	Radiological Physics (Part-2)	50		25	75	100
BMIT103	Dark room (Part-1): Radiographic Film/ Image Processing Techniques	50		25	75	100
BMIT104	Dark room (Part-2): Radiographic Film/ Image Processing Techniques	50		25	75	100
BMIT105	Human Anatomy, Physiology and Pathology relevant to Radiology (Part - 1)	50		25	75	100
BMIT106	Human Anatomy, Physiology and Pathology relevant to Radiology (Part -2)	50		25	75	100
BMIT107	Duties of Radiographer, Care & Preparation of Patients in the Radiology	50		25	75	100
BMIT108	Introduction to Basic Computers in Radiology and Biostatistics	50		25	75	100
Practicals						
BMIT151	Radiological Anatomy and Physiology Laboratory		340*	25	75	100
BMIT152	Dark room & Processing Techniques Laboratory		340*	25	75	100

* 340 hr of clinical/technical postings + total 60 hrs of experiments

L: Lecture hours in a year

P: Lecture hours in a year

TCE: Teacher's Continuous Evaluation Component (Internal Assessment)

TEE: Term End Examinations (Annual Examination) Component

MM: Maximum Marks

Second Year

Code	Paper Name	L	P	Marks Distribution		
				TCE	TEE	MM
Theory						
BMII201	General positioning (Part-1)	50		25	75	100
BMII202	General positioning (Part-2)	50		25	75	100
BMII203	X-ray equipment (Part-1)	50		25	75	100
BMII204	X-ray equipment (Part-2)	50		25	75	100
BMII205	Basic principles of different Imaging Modalities	50		25	75	100
BMII206	Radiation Biology & Radiation detection	50		25	75	100
BMII207	Imaging Protocols in Scanning techniques in CT and MRI	50		25	75	100
BMII208	Basic Radiographic Techniques	50		25	75	100
Practicals						
BMII251	Radiological Physics Laboratory		340*	25	75	100
BMII252	General Positioning Laboratory		340*	25	75	100

* 340 hr of clinical/technical postings + total 60 hrs of experiments

L: Lecture hours in a year

P: Lecture hours in a year

TCE: Teacher's Continuous Evaluation Component (Internal Assessment)

TEE: Term End Examinations (Annual Examination) Component

MM: Maximum Marks

Third Year

Code	Paper Name	L	P	Marks Distribution		
				TCE	TEE	MM
Theory						
BMII301	Advance Physics of Modern Imaging Modalities	50		25	75	100
BMII302	Radiation Protection	50		25	75	100
BMII303	Image quality characteristics in different imaging modalities	50		25	75	100
BMII304	Research Methodology & Quality Control in Radiology	50		25	75	100
BMII305	Special Investigation Procedures	50		25	75	100
BMII306	Contrast Media used in Radiology & Imaging	50		25	75	100
BMII307	Radiotherapy and Radionuclide Imaging	50		25	75	100
BMII308	Future developments in medical imaging	50		25	75	100
Practicals						
BMII251	Radiation Protection Laboratory		340*	25	75	100
BMII252	Special Investigation Laboratory		340*	25	75	100

* 340 hr of clinical/technical postings + total 60 hrs of experiments

L: Lecture hours in a year

P: Lecture hours in a year

TCE: Teacher's Continuous Evaluation Component (Internal Assessment)

TEE: Term End Examinations (Annual Examination) Component

MM: Maximum Marks

SYLLABUS

1. Measurements of physical quantities and units in C.G.S. and S.I. System.
2. Electrical Charges, Potential difference, Ohm's law, Electrical power.
3. Capacitor and capacitance, parallel and series connection, application of Capacitor in x-ray circuits.
4. Conductor, Insulators and semi-conductors, Current and resistance. Parallel and series connections, basic uses.
5. Direct and Alternating current, ammeters and voltmeters.
6. Introduction to Electrical Machines: Faraday's Law of electromagnetic induction, Lenz's law, induced EMF, self and mutual induction.
7. Working principle and basic construction features of Transformer, different types, type used in X-ray unit, losses, efficiency and regulation, autotransformer.
8. Thermionic Emission vacuum Tube Diode and Triode valve.
9. Semiconductors: Structure of atom, vacancy, conductor, semiconductor insulator. Intrinsic semiconductor, doping, P and N types of semiconductors. Diodes: P-N Junction, PN Diode as Rectifier, Types of rectification and methods used in diagnostic units. PNP and NPN Transistor.
10. Electromagnetic Radiation, EM Spectrum,
11. X-rays, properties of X-rays. discovery of x-rays, basics of X-Ray tube, X-Ray tube failure, concept of kV, mA, and mAs.
12. Distance and Inverse square law.
13. Basic radiation Quantities and units. Measurement of Radiation. Radioactivity, half-life, activity isotopes isobars, property of Gamma rays. Alpha, Beta, gamma decay, isomeric transition, Production of Radioactive material – Reactor produced radioactive materials.

1. X-ray tube production of heat, production of X-ray, characteristic and Bremsstrahlung x-rays, x-ray spectrum, factor affecting X-ray spectrum.
2. X-ray tube stationary and rotating anode tube
3. X-ray tube housing cathode assembly, anode assembly, in stationary and rotating anode tube. Modern X-ray tubes. Grid controlled tube, X-ray tubes for mammography. ceiling tube supports.
4. Collimation, Filtration, Heat units, joules, tube rating charts, Faults in X-Ray tube.
5. Interaction of radiation with matter, particulate interaction, X-ray and Gamma-ray interaction, coherent scattering photo-electric absorption (effect), Compton scattering, pair production, photo-disintegration
6. Scattered Radiation and factor affecting scattered radiation.
7. X-ray attenuation Linear attenuation coefficient, HVL, application of photo-electric absorption (effect) and Compton scattering in diagnostic radiology.
8. Revision of X-ray quantities and units (conventional and SI unit) of exposure, absorbed dose, equivalent dose & effective dose, SI unit of exposure, absorbed dose, equivalent dose and effective dose, concept of one roentgen, one red, one Rem, Sievert and Gray.
9. Grids Control of scattered Radiation, significance of Scatter, Secondary Radiation Grid, Grid movement, Grid functions.

1. Photosensitive chemicals, manufacture of emulsion, light sensitive and X-ray-sensitive emulsion.
2. Sensitometry- Photographic performance evaluation of emulsion characteristics- optical density, log-relative exposure characteristic curve.
3. Film construction - Film material, film base, emulsion, super coating, speed of the films. Irradiation Anti halo. Double emulsion film – screen type, including OPG film, double emulsion film – non screen type (Dental films). Single emulsion film- screen type (mammographic film) Single emulsion film, duplicating film, single emulsion film.
4. Storage of X-ray films and its transportation.
5. Luminescence-fluorescence and phosphorescence, Thermo-luminescence. Fluorescent screens.
6. Cassettes – Cassette Construction, types of cassette, care for cassettes testing for screen film contact and light leakage. Special cassettes-, ultrasound, OPG, dental etc.
7. Intensifying screens - Construction, care of intensifying screens, intensification factor, size of crystals.
8. Types of intensifying screens, Screen used in direct fluoroscopy, rare earth screens, phosphors.

1. Radiographic Processing: Principles, acidity, alkalinity and pH. X-ray developer, fog and staining possibilities and long active life.
2. Developing agents-function and constituents of the developer- in manual and automatic processor, standardization by time and temperature-Process of development-latitude-exhaustion of developer-regeneration by replenishment.
3. Fixation-fixing agents-constituents of radiographic fixer in manual and automatic processor and function of the chemicals-fixation time-exhaustion of fixer-silver silver recovery. Film rinse-acid stop bath-washing of films.
4. Practical processing-preparation of solutions-water supply, order of mixing chemicals, stock solutions.
5. Storage of dry chemicals and liquid concentrates. Processing apparatus - temperature control-immersion heaters-thermostatic, cooling and refrigeration cooling.
6. Automatic processor Developer, fixer, film transport, cycle time, capacity, feed section, developer section feed section washing section, drying section, Replenishment
7. Care and maintenance of auto-processors.
8. Technical and processing faults-fog, static, pressure, screen artifacts.
9. The X-ray Dark Room: minimum dimensions, services required, planned circulation and layout, lighting, ventilation, radiation protection and chemical-proof, materials bench design, film hoppers, pass-box, fixers or wash tanks-illumination and separate drying room with drying cabinets, wet or dry viewing rooms following manual and automatic processing.
10. Presentation of the radiograph: identification.
11. Accessories: viewing boxes, magnifier-high intensity localized viewers, projectors and viewing screens.
12. Silver recovery justification of silver recovery, amount of silver in fixer electrolysis recovery.

Paper Code: BMIT105

Paper: Human Anatomy, Physiology and Pathology relevant to
Radiology (Part – 1)

1. Introduction: Definition of anatomy and its divisions, Terms of location, positions and planes. Cell and its organelles, Tissues & its classification, Glands. Blood-its composition and function.
2. Musculoskeletal system: Structure of Bone & its types. Joints- Classification of joints with examples; details of synovial joint. Bones & joints of upper limb, lower limb and their movements. Axial skeleton & appendicular skeleton. Skull, spine & its movements, intervertebral disc. Classification of Muscles with function.
3. Cardiovascular System: Arteries & veins, Capillaries & arterioles. Heart-size, location, chambers, blood supply of heart, pericardium. Systemic & pulmonary circulation. Major blood vessels of Heart- Aorta, pulmonary artery, common carotid artery, subclavian artery, axillary artery, brachial artery, common iliac artery, femoral artery. Inferior vena cava, portal circulation, great saphenous vein.
4. Digestive System: Peritoneum with gross structure G.I. Tract. Oral cavity, Pharynx, Salivary glands, Oesophagus, stomach, small intestine, large intestine, liver, gall bladder, pancreas, spleen. Gastric enzymes and juices and its function
5. Respiratory system: Parts of Respiratory system; Structure of nose, nasal cavity, larynx, trachea, lungs, pleura, broncho pulmonary segments. Bronchial tree, Exchange of gases in Lungs and Respiration. Para nasal sinuses.
6. Urinary System: Parts of Urinary system, location and gross structure of kidney, ureter, urinary bladder, urethra. Formation of urine.

Paper Code: BMIT106

Paper: Human Anatomy, Physiology and Pathology relevant to
Radiology (Part -2)

- 1 Lymphatic System: Lymph & Lymph vessels. Structure of lymph node, names of regional lymphatics, axillary and inguinal lymph nodes.
- 2 Reproductive system: Parts of male reproductive system, gross structure of testis, vas deferens, epididymis, prostate. Parts of female reproductive system, gross structure of uterus, ovary, fallopian tube, mammary gland.
- 3 Endocrine glands: Name of all endocrine glands, gross structure & functions of pituitary gland, adrenal gland, thyroid gland and parathyroid gland.
- 4 Nervous system: Neuron, classification of NS. Meninges, ventricles, CSF. Gross features of cerebrum, midbrain, pons, medulla oblongata, cerebellum, name of basal nuclei. Blood supply of brain, cranial nerves. Spinal cord and spinal nerves. Autonomic nervous system. Visual & auditory pathways
- 5 Sensory Organs: Skin & its appendages. Structure of eye & lacrimal apparatus, name of extraocular muscles. Structure of ear: external, middle & inner ear.
6. Pathology Relevant to Radiology: General Pathology Adaptations: Cell Injury and Repair, Hyperplasia, atrophy, metaplasia, necrosis. Acute and Chronic inflammation: Five cardinal signs of inflammation Outcomes of acute inflammation- Chronic inflammation - Granulomatous, wound healing, Thrombosis, Embolism. Infarction - Shock Bronchial asthma, COPD. Neoplasia: Definition of neoplasia. Differences between benign and malignant tumours; Metastasis; Carcinogenesis Causes; Carcinoma of oral cavity Causes; Aetiology of Carcinoma cervix Screening investigations; Breast carcinoma Risk factors. Systemic Pathology. RBC and Bleeding disorders: Anaemia Definition and classification, Haemolytic anaemia, Iron deficiency anaemia. WBC disorders: Leukaemia acute and chronic causes. Disease of the GIT: Peptic ulcer causes; Carcinoma stomach causes; Intestinal obstruction causes; acute appendicitis – causes; Colonic carcinoma causes. Diseases of Liver, Biliary tract and Pancreas: Jaundice Cirrhosis Definition and causes; Hepatitis Types of viral hepatitis and transmission; Portal hypertension. Endocrine System: Diabetes mellitus, Differences between type I and Type II diabetes mellitus, Complications of diabetes mellitus. Blood vessels: Atherosclerosis, Varicose veins. The Heart: Heart failure, congenital heart diseases, Myocardial infarction. Diseases of the Lung: Chronic obstructive pulmonary disease; Asthma pathogenesis; Pneumonia, Lung carcinoma

1. Clinical and legal responsibility of the radiographer.
2. Hospital staffing and administration, records, professional, ethics, co-operation with other staff and departments,
3. Departmental organization. Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non-English-speaking patients.
4. Understanding patient needs- patient dignity of inpatient and outpatient. Interaction with the patients' relatives and visitors.
5. Methods of effective communication: verbal skills, body language, professional appearance, visual contact etc.
6. Elementary personal and departmental hygiene, dealing with receptacles, bed pans and urinal etc.
7. General preliminaries to the exam. Moving chair and stretcher, patient. Unconscious patient general comfort and reassurance for the patient.
8. Vital signs: Body temperature, respiratory rate, pulse blood pressure, oxygen devices.
9. First aid for shock, electrical shock, haemorrhage, burns, asphyxia, fractures, loss of consciousness.
10. Emergency treatment to the collapsed patient.
11. Artificial respiration and resuscitation.
12. Preparation of patient for general and special radiological examinations.
13. Supervision of patients undergoing special examination.
14. Administration of drugs and contrast media.
15. Aseptic and sterile procedures. Handling of infections patients in the department or in the ward.
16. Trolley set up for special X-ray examinations.
17. Radiation hazardous and protective measures.

1. Introduction to Computer – Window and Internet: Introduction to computers. Windows 2000 Interface – XP. Windows Explorer and Application. Introduction to Internet and E- Mail.
2. MS Word: Introduction to MS Word. Formatting Documents. Desktop Publishing Features, Advanced features in word
3. Introduction to MS Excel and Power point: Introduction to MS Excel, Advanced features of Microsoft Excel, Introduction to Microsoft Power point, Advanced feature of MS Power point
4. Computer in Radiology: Computerization in Radiology, Networking in Radiology, Electronic Patient record
- 5: Biostatistics: Definition, use of statistics, scale of measurement, Frequency distribution and graphical presentation of data, Mean, Median, Mode, Standard deviation, Normal probability and test of significant

Paper Code: BMIT151

Paper: Radiological Anatomy and Physiology Laboratory

1. Demonstration of all bones and organs of the human body with charts.
2. Recording of normal Blood Pressure
3. Clinical Examination of Arterial Pulse
4. Determination of Vital Capacity

Paper Code: BMIT152

Paper: Dark room & Processing Techniques Laboratory

1. Test to check the X-ray films and screen contact in the cassette
2. Test to check light leakage in the cassette
3. Processing of films in dark room
4. To check the effect of safe light on exposed as well as unexposed X-ray film

1. Skeletal system:

a) Upper limb: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio ulnar joints and humerus. Supplementary techniques. e.g., Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections.

b) Lower limb: Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella and femur. Supplementary techniques. stress view for torn ligaments, subtalar joint and talo-calcaneal joint, inter condylar projection of the knee, tibial tubercle, length measurement technique.

c) Shoulder girdle and thorax: Technique for shoulder joint, scapular, clavicle, acromioclavicular joints, sternum, ribs, sterno-clavicular joint. Supplementary projections and techniques. • Recurrent dislocation of shoulder. • Traumatic dislocation of shoulder. • Cervical ribs.

d) Vertebral column: Technique for atlanto-occipital joint, cervical spine, cervicothoracic spine, thoracic spine, thoraco-lumbar spine, lumbosacral spine, sacrum and coccyx. Supplementary techniques to demonstrate: Scoliosis, Kyphosis, Spondylolisthesis, disc lesion, Union of spinal graft.

e) Pelvic girdle and hip region: Technique for whole pelvis. Ilium, ischium, pubic bones, sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter. Supplementary techniques-Congenital dislocation of hips Epiphysis of femur, Lateral projections for hip joints to show femoral head and neck relationship.

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

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

4. Radiography using mobile X-ray equipment- Radiography in the ward: Radiography in the specialized unit, such as: Intensive care unit, Coronary care, Neonatal unit. Radiography in the operating theatre.

1. Radiography technique comprising of the complete
2. Radiography of skull and radiography of cranial bones; including special techniques for sella turcica, orbits, optic foramina, superior orbital fissure and inferior orbital fissure mandible, pituitary fossa, zygomatic arch.
3. Facial bones; Paranasal sinuses, Temporal bone and Mastoids.
4. Dental Radiography: Radiography of oral, extra oral and occlusal view.
5. Abdomen: Preparation of patient. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen. Technique to demonstrate foreign body, Imperforate anus (Invertogram).
6. Macro radiography: Principle, advantage, technique and applications.
8. High KV techniques principle and its applications.
9. Soft tissue Radiography including Mammography - its techniques, equipment, advancements and applications.
10. Localization of foreign bodies. Various techniques
11. Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.
12. 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.
13. Trauma radiography/Emergency radiography
14. Neonatal and Paediatric Radiography,
15. Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.

1. Theory of computed tomography, generations of computed tomography
2. Dental radiography, general dental X-ray equipment, OPG equipment, mammography equipment.
3. Exposure timers, assessing the milliamperes, kilovoltages.
4. Measurement of the focal spot of An x-ray tube, testing the light-Beam Diaphragm, Indications of the failure of an x-ray Tube.
5. High tension cables.
6. Accessories and immobilization devices used in special situation like paediatric Radiography, Automatic pressure Injectors and monitoring device equipment.
7. Care and maintenance of equipment

1. Electric system and mains supply- electric system, generation of electrical energy, Distribution of electrical energy, use of electrical energy.
2. The rectification of High Tension, kilo voltage control and indication, filament circuit and control of Tube current.
3. Milliampere(mA) indication, mains voltage compensation, main supply and the x-ray set. High Tension generator - Rating of x-ray generators. The self-rectified, half wave, full wave rectified circuit.
4. Three phase six pulse 6 rectifier and 12 rectifiers. Three phase twelve pulse 12 rectifier circuit, High Frequency and medium Frequency generators, constant potential circuit, the falling Load generators.
5. Portable and mobile X-ray equipment, mains requirements, portable x-ray equipment, Mobile x-ray equipment, capacitor discharge Mobile equipment, x-ray equipment for operation theatres.
6. Fuses, switching and interlocks- switches and circuit broker, exposure switches and exposure timers, switching system, exposure switching.
7. Image intensifier tube, principles of image intensification,
8. Television and digital image principle of television, television fluoroscopy,
9. Fluoroscopy modes of operation, Automatic Brightness control, standards. Fluoroscopic Tables.

1. Computed Tomography: Basic principles and historical development. CT detectors solid state detector, Photomultiplier tube detector and detector array.
2. Principles in formation of CT image, Digital image display. Different generation CT Spiral CT, Multi-slice CT Details of acquisition tomographic reconstruction techniques and CT artifacts.
3. Ultrasound Imaging: Basic Physics, Interaction of ultrasound with tissues, reflection, absorption refraction of ultrasound waves. Piezoelectricity, Transducer- structure of transducer
4. Doppler imaging- Principles, Continuous, Pulse wave USG, colour Flow imaging, USG artifact.
5. Nuclear Magnetic Resonance: magnetization properties, generation and detection of magnetic resonance signal. Basic principles in formation MR Image. Pulse sequence. Spin-echo sequence.
6. T1, T2 and proton density weighted image. Localization of MR signal and image reconstruction 3D Fourier transform image acquisition. Pulse sequences-SPIN ECHO types, Inversion Recovery STIR, FLAIR, Gradient coils, Echo Imaging.
7. Main magnet, super conducting magnet, gradients coils, different types of RF coils used in MRI, safety and accident, MR Artifacts.

1. Biological effect of ionizing Radiation, Cell biology, Interaction of radiation with cells
2. Stochastic and deterministic effect of radiation induced cancer
3. Biological effects at organ system
4. Natural and man-made radiation.
5. Radiation detection and measurement
6. Gas filled detector-ionizations chamber, GM Counter
7. Scintillation detectors,
8. Thermo-luminescent detector. Personal monitoring- film badge, TLD badge
9. Radiation protections, units, aims and objectives.
10. ALARA Principles. protective devices lead apron, lead gloves mobile protective barriers.

1. CT Protocols - general description about the basic parameters used in computed tomography scanning
2. Scan Mode - ultra fast, standard, high resolution, slice width, pitch.
3. Filming - window width, level
4. Ionic and nonionic contrast agents.
5. Clinical indication, patient positioning, patient preparation.
6. Scan protocols for routine and contrast enhanced. imaging of head, neck, shoulder, thorax, abdomen, spine, pelvis, cardio and extremities
7. MR Protocols - General Description about the basic parameters used in MR Imaging
8. FOV, matrix size, slice thickness, TR, TE, TI, Flip.
9. Concept of coronal, sagittal, transverse and oblique plane
10. Basic contrast mechanism, spin echo, gradient echo, ultra-fast gradient echo.
11. 3D acquisition modes, MR artifacts.
12. Indications and protocols for brain, neck, thorax, abdomen and pelvis.
13. Indications and imaging protocols for paramagnetic contrast enhanced MRI.

1. Radiography general principles- Evaluation criteria, Positioning Accuracy: film Marker and patient identification: radiographic technique and imaging quality: density: contrast anode heel effect: radiation protection: positioning principles.
2. Radiographic image unsharpness: Geometric, Photographic, motional unsharpness over and under penetration, identification the causes radiographic contrast fogging, graininess mottle image artifacts, distortion.
3. Exposure factors, KVP, mAs focal spot, filtration, FFD, collimation, TABLE TOP, Grids, film screen factors, film speed, screen speed, system speed contrast manipulation of exposure factors, worked examples, programmed exposures image quality control- benefits of quality control, monitoring of the Auto processor.
4. Projection Radiography: basic geometric principles: the screen film cassette; characteristics of screen: characteristics of films, scattered radiation in projection Radiography.
5. High voltage technique - general principles - relationship to patient dose-change in contrast; radiographic image effects of exposure sharpness-relationship between kilovoltage and exposure time & tube current (mAs).
6. Presentation for viewing of radiographs.
7. Image subtraction techniques, macro radiography- principles, magnification factor, quality of magnified image.
8. X-ray tube rating, application of macro radiography; other imaging modalities, rating, digital fluoroscopy, computed radiography, xero-radiography, photographic materials for CRT recording and film hard copy.
9. 3D and MRI reconstructions,
10. Duplicating film, duplicating equipment, procedure for duplication, quality of duplicated image.

Paper Code: BMIT251 Paper: Radiological Physics Laboratory

1. To evaluate output of a radiographic room
2. To compare output of different X-ray units
3. To measure table top exposure of fluoroscopic unit
4. To study heel effect
5. To measure high contrast resolution in fluoroscopy
6. To check the alignment of radiation beam.
7. To verify inverse square law

Paper Code: BMIT252 Paper: General Positioning Laboratory

1. Skull-AP, Lat. Base of Skull, Caldwell's, Town's, Sub-Mento-Vertical (SMV) View
2. View for optic foramina
3. Paranasal sinuses – Water's view
4. Mandible Series – Oblique view, AP View
5. Nasal bones – Lat.
6. Mastoids – Lateral oblique, town's view, Stenver's view, Schuller's projection
7. Temporomandibular joint – open and close mouth
8. Cervical spine – AP, Lat, open mouth projection, moving jaw
9. shoulder-AP, Axial view
10. Wrist -PA/AP Oblique, Ulnar flexion, Carpal tunnel view, Scaphoid Series
11. Calcaneum axial
12. Chest – PA, Lateral Decubitus, Lordotic view, Apicogram
13. Abdomen-AP (Erect); AP (Supine) Lat, KUB
14. Lumbosacral spine – AP/Lat/ oblique
15. Sternum – Lateral Oblique
16. Knee – AP, Lateral, Skyline view, Tunnels view
17. Scapula series

1. Digital Projection Radiography- Charge couple device, Flat panel detector, Direct and indirect detector
2. Computer radiography
3. Digital mammography.
4. Display in digital imaging and further development.
5. Dual source CT, Virtual colonoscopy, Maximum Intensity projection(MIP), 3D
6. Calcium scoring
7. CT angiography Cerebral, Carotid, Pulmonary, Abdominal (Triple phase), Upper and lower limbs.
8. Doppler sonography and advanced scanning technique and equipment and further development, 3-D USG, Colour flow imaging and USG contrast media.
9. Functional MRI perfusion and diffusion contrast magnetization. Image characteristics MR angiography and magnetization transfer, MR spectroscopy.
10. Bone densitometry - DEXA imaging.

1. Introduction to Radiation protection.
2. Risk control in Medical exposure, estimation of effective doses, justification of exposure, optimization of Techniques, Paediatric exposure, avoidance of repeat exposure.
3. Radiation protection for a pregnant patient.
4. Patient dose and image Quality factor affecting patient dose and image quality, factor influencing staff dose.
5. Diagnostic Radiology Planning of Radiology department, design- Protective barrier, window, floor and ceiling, warning sign, equipment locations, layout, room size, shielding, illumination, control panels, waiting area.
6. Details of radiation Protection rules -2004 and guide lines issued by AERB. Requirement for Approval of plan lay out and licensing and registration of x-ray units, CT by AERB.
7. Radiation Dosimetry, Patient dose estimation in conventional and Radiography, fluoroscopy, Doses in Computed Tomography CTDI, bone mineral densitometry (BMD) and estimation of effective doses.
8. Operating theatre techniques-revision of procedure in collaboration with theatre staff- Checking of mains supply and function of apparatus.

1. Image characteristics and quality – image quality, image viewing condition, reflected, transmitted and emitted light images, noise, signal to noise- ratio, contrast, optimum contrast, sharpness, resolution.
2. X-ray image formation and contrast, Effect of kVp.
3. Radiographic Receptors- Image blurs, image noise, artifacts.
4. Film contrast characteristic – characteristic curve, optical density, film latitude, film fog
5. Blur, unsharpness.
6. Radiographic details- object location and magnification, motion blur.
7. Image quality in Computed tomography – contrast sensitivity, blur and resolution noise and artifacts.
8. Image quality in MRI – image details, image noise, noise sources, SNR, image acquisition time, procedures optimization.

Research Methodology

1. Understanding research design: Qualitative and quantitative methodologies – their differences and potential integration. Evaluation research and its potential for informing practice. Developing research questions and division methods for their investigation.
2. Analysis: Analysis of qualitative and quantitative data. Utilization of appropriate software to assist in the retrieval of information and data analysis.
3. Clinical Audit: Distinctiveness of research and audit processes in their function
4. Research skill and Management: The role of evidence-based practice within health and welfare

Quality Control in Radiology

1. 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.
2. Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.
3. Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion, Artifacts of films and image recording. Monitor calibration.
4. 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 equipment; Record keeping and log book maintenance.

1. Gastrointestinal Tract: Barium Swallow, Barium Meal, Barium Meal follow through , Barium Enema
2. Urinary Tract: Intravenous urography, Retrograde pyelography, Cystography, Micturating cystourethrography.
3. Biliary Tract: Cholecystography, T-Tube Cholecystography, ERCP,
4. Genital Tract: Hysterosalpingography
5. Sinogram : Fistulogram
6. Salivary gland : Sialo gram
7. Angiogram: Cerebral, Carotid, Pulmonary, Peripheral, Venography
8. Aortogram: Ascending, Arch, Descending
9. Angiocardiography: Calcium score, Coronary Angiography

1. Introduction of contrast media.
2. Positive and Negative contrast media.
3. Water soluble contrast media
4. Quantity of contrast agent used.
5. Properties of different contrast media.
6. Chemical composition of different contrast media.
7. Concentration and uses of contrast media.
8. Reactions of Contrast media.
9. Contrast induced Nephropathy.
10. Calculation of estimated Glomerular filtration rate

1. Introduction to Radiotherapy
2. Radiation Therapy – Percentage depth dose, Factor influencing Percentage depth dose.
3. Brachytherapy
4. Teletherapy
5. Radionuclide decay terms and relationship nuclear transformation radionuclide production. Radionuclide used in nuclear medicine and radionuclide laboratories.
6. Radiation protection requirement in Nuclear medicine, special consideration in PET department Radioactive waste management.
7. Radiation measurement in nuclear medicine - Types of detectors Gas filled detectors, scintillation detector semiconductor detectors.
8. Radiation protection considerations in pregnant and breast feeding patient, Positron emission tomography.
9. Physics, techniques instrumentation and PET/CT.
10. Clinical application of radionuclide scanning.

1. Magnetic source imaging, MR Screening, MRCP.
2. Phase contrast MR imaging, Phase contrast CT Imaging
3. Digital subtraction techniques.
4. Dual energy x-ray Absorptiometry (DEXA).
5. Positron emission tomography (PET) CT.
6. Picture archiving and communication system (PACS), Tele-radiology
7. Hospital Information system and communication
8. Soft copy viewing
9. Component incompatibility, data storage requirement, work station design
10. Technical assessment
11. Any recent advances in CT, MRI, USG.

Paper Code: BMIT351

Paper: Radiation Protection Laboratory

1. To survey the operation of an X-ray unit for deficiency in radiation safety.
2. To check the radiation protection level diagnostic fluoroscopic installation.
3. To check the integrity of lead apron using fluoroscopy
4. To survey the operation of Digital fluoroscopy unit for deficiency in radiation safety
5. To survey the operation of CT unit for deficiency in radiation safety.
6. To check protection of dark room for exposed films

Paper Code: BMIT352

Paper: Special Investigation Laboratory

1. Barium Series including double contrast examinations
2. Pyelography in normal adult, in child, diabetic patients and raised kidney function.
3. HSG with regular menstrual cycle.
4. Procedure to visualize biliary tract including T-tube
5. Barium enema in child with suspected Hirschsprung's disease
6. Choice and alternative of contrast agent
7. Use of fluoroscopy in chest.
8. Use of technique in Micturating Cystourethrography
9. Use of techniques in USG
10. Use of techniques in CT
11. Use of techniques in MRI

Books: Since the field is a developing field, the following list may be used for teaching purposes. The teacher concerned may add a or any book to the prescribed list of books.

1. Bontrager K.L. (2017), Textbook of Radiographic Positioning and Related Anatomy (9th edition), Mosby, ISBN 0323481876, Core text for Anatomy & Physiology for Radiographers (PAM1019).
2. Carlton R.R. and Adler A.M. (2013), Radiographic Imaging Concepts and Principles (5th edition), Delmar, ISBN 1473720524, Core text for Fundamentals of Radiographic Practice (PAM1020) and Medical Imaging Applications (PAM2013).
3. Chan, O. 3rd edition (2013) ABC of Emergency Radiology. Wiley-Blackwell. ISBN 9781118495193
4. Eisenberg R.L. and Johnson N.M. (2016), Comprehensive Radiographic Pathology (6th edition), Mosby, ISBN 9780323353243, Core text for Pathology & Image Interpretation 1 (PAM2014).
5. Graham D.T., Cloke P. and Vosper M. (2012), Principles and Applications of Radiological Physics (6th edition), Churchill Livingstone, ISBN 9780702052156 , Core text for Fundamentals of Radiographic Practice (PAM1020) and Science for Medical Imaging (PAM2011).
6. Gunn C. (2014), Bones and Joints: A Guide for Students (7th edition), Churchill Livingstone, ISBN 9780702071737, Core text for Anatomy & Physiology for Radiographers (PAM1019).
7. Kumar, P. and Clark, M. (2016), Kumar and Clark's Clinical Medicine (9th edition), Elsevier, ISBN 9780702066009, Core text for Pathology and Image Interpretation 1 (PAM2014).
8. McConnell J., Eyres R. and Nightingale J. (2005), Interpreting Trauma Radiographs, Blackwell, ISBN 1-4051-1534, Core text for Skeletal Image Interpretation (PAM3006).
9. Polgar S. and Thomas S.A. (2013), Introduction to Research in the Health Sciences (6th edition), Churchill Livingstone, ISBN 978-0702041945, Core text for Research and Evidence Based Professional Practice (PAM1016) and Project Studies 1 (PAM2007). Supplementary for Project Studies 2 (PAM3004).
10. Raby N. (2014), Accident and Emergency Radiology - A Survival Guide (3rd edition), Saunders Ltd, ISBN 9780702042324, Core text for Practice Placement 2 (PAM2006), Pathology & Image Interpretation 1 (PAM2014) and Skeletal Image Interpretation (PAM3006). Supplementary for Practice Placements 1 & 3 (PAM 1007 & 3005)
11. Ramlaul, A. (2014), Medical Imaging and Radiotherapy Research: Skills and Strategies, Churchill Livingstone, ISBN 9780702048289, Core text for Project Studies 1 (PAM2007), Supplementary text for Project Studies 2 (PAM3004).
12. Tortora G.J. and Derrickson B. (2017), Principles of Anatomy and Physiology (15th edition), John Wiley, ISBN 9781119336563, Core text for Anatomy and Physiology for Radiographers (PAM1019), Supplementary for Pathology & Image Interpretation 1 (PAM2014) and Skeletal Image Interpretation (PAM3006).
13. Whitley AS, Jefferson G, Holmes K, Hoadley G, Sloane C, Anderson C. (2015) Clark's Positioning in Radiography (13th edition). CRC Press, London. ISBN 9781444122350, Core text for PAM1007 (Practice Placement 1) & Fundamentals of Radiographic Practice (PAM1020), Supplementary for Practice Placement 2 (PAM2006) and Practice Placement 3 (PAM3005)
14. Baggott R. (2004), Health and Health Care in Britain (3rd edition), Palgrave Macmillan, ISBN 0-333-96159-5, Supplementary for Professional Skills for Radiographers (PAM3015) and Placement for Health Science (PAM3014).

15. Dougherty, G. (2009), Digital Image Processing for Medical Applications, Cambridge University Press, ISBN 9780511532528, Supplementary text for Digital Image Processing (PAM3012)
16. Drake R.L., Vogl W. and Mitchell A.W.M. (2014), Gray's Anatomy for Students (3rd edition), Churchill Livingstone, ISBN 9780702051333, Supplementary for Anatomy and Physiology for Radiographers (PAM1019).
17. Ehrlich R.A. and Daly J.A. (2017), Patient Care in Radiography (9th edition), Mosby, ISBN 9780323377713, Supplementary for Foundations of Patient Care (PAM1018).
18. Kremkau F.W. (2016), Sonography: Principles and Instruments (9th edition), Saunders, ISBN 978-0323322713, Supplementary for Medical Imaging Applications (PAM2013).
19. Pocock G. and Richards C.D. (2017), Human Physiology: The Basis of Medicine (5th edition), Oxford University Press, ISBN 9780198737223.

General Instructions:

1. The programme shall be governed by Ordinance 10 of the University.
2. Minimum Duration of the programme shall be 3 (three) years.
3. Maximum Duration of the programme shall be 3 + 2 = 5 years.
4. All papers must be cleared for the award of the degree.
5. For the purpose of calculation of the SGPA / CGPA as per Ordinance 10, all papers deemed to carry 1 credit.
6. Passing marks in each paper to be 40.
7. The promotion criteria specified in Ordinance 10 shall be applicable.
8. The total numbers of hours of the course is 3600 Hours (1200 hours of Theory, 2040 hours of Clinical/Technical posting and 360 hours of experiments).
9. The medium of instructions for the programme shall be English.
10. For the purpose of teaching, each year shall be partitioned in two part (of six months each). Papers offered in a year, as a two part paper shall be taught sequentially (one in the first part of the academic year and the Part 2 in the second part of the academic year).
11. Sessional or teachers continuous examination to be conducted as per the schedule prescribed by the Academic Programme Committee of the Institution where the programme of study is being offered. Criteria for Calculation of Internal Assessment of 25 marks shall be as:
 - a. Class Examinations - 20
 - b. Attendance (above 90%) - 3
 - c. Subject assessment (candidate's conduct and extra-curricular participation) - 2

B.Sc. Medical Imaging Technology

*Course Syllabus,
Content-wise distribution of teaching &
practical hours,
and
Examination scheme*



University School of Medicine & Paramedical Health Sciences
Guru Gobind Singh Indraprastha University

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Duration of the course

3 years or 6 semesters (1200 hours of Theory, 2040 hours of Clinical/Technical posting and 360 hours of experiments).

Total Hours - 3600

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B.Sc. Medical Imaging Technology

Course details

Year -1 Semester -1 Paper -1
Course Code: BMIT - 101

Radiological Physics Part-1

Basic Physics, Electricity and Magnetism, and Nuclear Physics

1. Measurements of physical quantities and units in C.G.S. and S.I. System.
2. Electrical Charges, Potential difference, Ohm's law, Electrical power.
3. Capacitor and capacitance, parallel and series connection, application of Capacitor in x-ray circuits.
4. Conductor, Insulators and semi-conductors, Current and resistance. Parallel and series connections, basic uses.
5. Direct and Alternating current, ammeters and voltmeters.
6. Introduction to Electrical Machines: Faraday's Law of electromagnetic induction, Lenz's law, induced EMF, self and mutual induction.
7. Working principle and basic construction features of Transformer, different types, type used in X-ray unit, losses, efficiency and regulation, autotransformer.

8. Thermionic Emission vacuum Tube Diode and Triode valve.
9. Semiconductors: Structure of atom, vacancy, conductor, semiconductor insulator. Intrinsic semiconductor, doping, P and N types of semiconductors. Diodes: P-N Junction, PN Diode as Rectifier, Types of rectification and methods used in diagnostic units. PNP and NPN Transistor.
10. Electromagnetic Radiation, EM Spectrum,
11. X-rays, properties of X-rays. discovery of x-rays, basics of X-Ray tube, X-Ray tube failure, concept of kV, mA, and mAs.
12. Distance and Inverse square law.
13. Basic radiation Quantities and units. Measurement of Radiation. Radioactivity, half-life, activity isotopes isobars, property of Gamma rays. Alpha, Beta, gamma decay, isomeric transition, Production of Radioactive material – Reactor produced radioactive materials.

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Year -1 Semester -1 Paper -2
Course Code: BMIT- 102

Radiographic Film/ Image Processing Techniques Part-1

Image receptor and Recording System

1. Photosensitive chemicals, manufacture of emulsion, light sensitive and X-ray-sensitive emulsion.
2. Sensitometry- Photographic performance evaluation of emulsion characteristics- optical density, log-relative exposure characteristic curve.
3. Film construction - Film material, film base, emulsion, super coating, speed of the films. Irradiation Anti halo. Double emulsion film – screen type, including OPG film, double emulsion film –non screen type (Dental films). Single emulsion film-screen type (mammographic film) Single emulsion film, duplicating film, single emulsion film.
4. Storage of X-ray films and its transportation.
5. Luminescence-fluorescence and phosphorescence, Thermo-luminescence. Fluorescent screens.
6. Cassettes – Cassette Construction, types of cassette, care for cassettes testing for screen film contact and light leakage. Special cassettes-, ultrasound, OPG, dental etc.

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7. Intensifying screens - Construction, care of intensifying screens, intensification factor, size of crystals.
8. Types of intensifying screens, Screen used in direct fluoroscopy, rare earth screens, phosphors.

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Year -1 Semester -1 Paper -3
Course code: BMIT - 103

Basic Human Anatomy and Physiology - Part 1

1. Introduction:

- ② Definition of anatomy and its divisions, Terms of location, positions and planes.
- ② Cell and its organelles, Tissues & its classification, Glands.
- ② Blood-its composition and function.

2. Musculoskeletal system:

- ② Structure of Bone & its types.
- ② Joints- Classification of joints with examples; details of synovial joint.
- ②* Bones & joints of upper limb, lower limb and their movements.
- ② Axial skeleton & appendicular skeleton.
- ② Skull, spine & its movements, intervertebral disc.
- ② Classification of Muscles with function.

3. Cardiovascular System:

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- ☐ Arteries & veins, Capillaries & arterioles.
- ☐ Heart- size, location, chambers, blood supply of heart, pericardium.
- ☐ Systemic & pulmonary circulation.
- ☐ Major blood vessels of Heart- Aorta, pulmonary artery, common carotid artery, subclavian artery, axillary artery, brachial artery, common iliac artery, femoral artery.
- ☐ Inferior vena cava, portal circulation, great saphenous vein.

4. Digestive System:

- ☐ Peritoneum with gross structure G.I. Tract.
- ☐ Oral cavity, Pharynx, Salivary glands, Oesophagus, stomach, small intestine, large intestine, liver, gall bladder, pancreas, spleen.
- ☐ Gastric enzymes and juices and its function

5. Respiratory system:

- ☐ Parts of Respiratory system; Structure of nose, nasal cavity, larynx, trachea, lungs, pleura, broncho pulmonary segments.
- ☐ Bronchial tree, Exchange of gases in Lungs and Respiration.
- ☐ Para nasal sinuses.

6. Urinary System:

- ☐ Parts of Urinary system, location and gross structure of kidney, ureter, urinary bladder, urethra.
- ☐ Formation of urine.

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Year -1 Semester -1 Paper -4
Course code: BMIT - 104

Subject: Duties of Radiographer

Care and Preparation of the Patients in Radiology

1. Clinical and legal responsibility of the radiographer.
2. Hospital staffing and administration, records, professional, ethics, co-operation with other staff and departments,
3. Departmental organization. Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non- English-speaking patients.
4. Understanding patient needs- patient dignity of impatient and outpatient. Interaction with the patients' relatives and visitors.
5. Methods of effective communication: verbal skills, body language, professional appearance, visual contact etc.
6. Elementary personal and departmental hygiene, dealing with receptacles, bed pans and urinal etc.
7. General preliminaries to the exam. Moving chair and stretcher, patient. Unconscious patient general comfort and reassurance for the patient.
8. Vital signs: Body temperature, respiratory rate, pulse blood pressure, oxygen devices.

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9. First aid for shock, electrical shock, haemorrhage, burns, asphyxia, fractures, loss of consciousness.
10. Emergency treatment to the collapsed patient.
11. Artificial respiration and resuscitation.
12. Preparation of patient for general and special radiological examinations.
13. Supervision of patients undergoing special examination.
14. Administration of drugs and contrast media.
15. Aseptic and sterile procedures. Handling of infections patients in the department or in the ward.
16. Trolley set up for special X-ray examinations.
17. Radiation hazardous and protective measures.

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Year -1 Semester -1 Practical- 5
Course code: MITP - 105

Practical in Radiological Anatomy and Physiology

1. Demonstration of all bones and organs of the human body with charts.
2. Recording of normal Blood Pressure
3. Clinical Examination of Arterial Pulse
4. Determination of Vital Capacity

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Year -1 Semester -2 Paper -1
Course Code: BMIT- 201

Subject: Introduction to Basic Computers in Radiology and Biostatistics

Introduction to Computer – Window and Internet

1. Introduction to computers
2. Windows 2000 Interface -XP
3. Windows Explorer and Application
4. Introduction to Internet and E- Mail

MS Word

1. Introduction to MS Word
2. Formatting Documents
3. Desktop Publishing Features
4. Advanced features in word

Introduction to MS Excel and Power point

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1. Introduction to MS Excel
2. Advanced features of Microsoft Excel
3. Introduction to Microsoft Power point
4. Advanced feature of MS Power point

Computer in Radiology

1. Computerization in Radiology
2. Networking in Radiology
3. Electronic Patient record

Biostatistics

1. Definition, use of statistics, scale of measurement
2. Frequency distribution and graphical presentation of data
3. Mean, Median, Mode, Standard deviation
4. Normal probability and test of significant

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Year -1 Semester -2 Paper -2
Course code- BMIT - 202

Subject: Radiological Physics Part-2

1. X-ray tube production of heat, production of X-ray, characteristic and Bremsstrahlung x-rays, x-ray spectrum, factor affecting X-ray spectrum.
2. X-ray tube – stationary and rotating anode tube
3. X-ray tube housing – cathode assembly, anode assembly, in stationary and rotating anode tube. Modern X-ray tubes. Grid controlled tube, X-ray tubes for mammography. ceiling tube supports.
4. Collimation, Filtration, Heat units, joules, tube rating charts, Faults in X-Ray tube.
5. Interaction of radiation with matter, particulate interaction, X-ray and Gamma-ray interaction, coherent scattering photo-electric absorption (effect), Compton scattering, pair production, photo-disintegration
6. Scattered Radiation and factor affecting scattered radiation.
7. X-ray attenuation Linear attenuation coefficient, HVL, application of photo-electric absorption (effect) and Compton scattering in diagnostic radiology.

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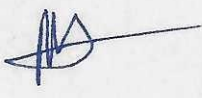
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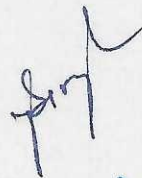
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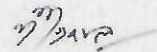
8. Revision of X-ray quantities and units (conventional and SI unit) of exposure, absorbed dose, equivalent dose & effective dose, SI unit of exposure, absorbed dose, equivalent dose and effective dose, concept of one roentgen, one rad, one Rem, Sievert and Gray.
9. Grids Control of scattered Radiation, significance of Scatter, Secondary Radiation Grid, Grid movement, Grid functions.


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Year -1 Semester -2 Paper -3
Course Code: BMIT - 203

Radiographic Film/ Image Processing Techniques Part-2

1. Radiographic Processing: Principles, acidity, alkalinity and pH. X-ray developer, fog and staining possibilities and long active life.
2. Developing agents-function and constituents of the developer- in manual and automatic processor, standardization by time and temperature-Process of development-latitude-exhaustion of developer-regeneration by replenishment.
3. Fixation-fixing agents-constituents of radiographic fixer in manual and automatic processor and function of the chemicals-fixation time-exhaustion of fixer-silver recovery. Film rinse-acid stop bath-washing of films.
4. Practical processing-preparation of solutions-water supply, order of mixing chemicals, stock solutions.
5. Storage of dry chemicals and liquid concentrates. Processing apparatus - temperature control-immersion heaters-thermostatic, cooling and refrigeration cooling.
6. Automatic processor – Developer, fixer, film transport, cycle time, capacity, feed section, developer section feed section washing section, drying section, Replenishment

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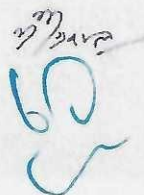
7. Care and maintenance of auto-processors.
8. Technical and processing faults-fog, static, pressure, screen artifacts.
9. The X-ray Dark Room: minimum dimensions, services required, planned circulation and layout, lighting, ventilation, radiation protection and chemical-proof, materials bench design, film hoppers, pass-box, fixers or wash tanks-illumination and separate drying room with drying cabinets, wet or dry viewing rooms following manual and automatic processing.
10. Presentation of the radiograph: identification.
11. Accessories: viewing boxes, magnifier-high intensity localized viewers, projectors and viewing screens.
12. Silver recovery – justification of silver recovery, amount of silver in fixer electrolysis recovery.


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Year -1 Semester -2 Paper -4
Course Code: BMIT - 204

Human Anatomy, Physiology and Pathology relevant to Radiology Part-2

1 Lymphatic System:

Lymph & Lymph vessels.

Structure of lymph node, names of regional lymphatics, auxiliary and inguinal lymph nodes.

2 Reproductive system:

Parts of male reproductive system, gross structure of testis, vas deferens, epididymis, prostate.

Parts of female reproductive system, gross structure of uterus, ovary, fallopian tube, mammary gland.

3 Endocrine glands:

Name of all endocrine glands, gross structure & functions of pituitary gland, adrenal gland, thyroid gland and parathyroid gland.

4 Nervous system:

Neuron, classification of NS.

Meninges, ventricles, CSF.

Gross features of cerebrum, midbrain, pons, medulla oblongata, cerebellum, name of basal nuclei.

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Blood supply of brain, cranial nerves.
Spinal cord and spinal nerves.
Autonomic nervous system.
Visual & auditory pathways

5 Sensory Organs:

Skin & its appendages.
Structure of eye & lacrimal apparatus, name of extraocular muscles.
Structure of ear: external, middle & inner ear.

Pathology Relevant to Radiology

General Pathology Adaptations: Cell Injury and Repair, Hyperplasia, atrophy, metaplasia, necrosis

Acute and Chronic inflammation: Five cardinal signs of inflammation Outcomes of acute inflammation- Chronic inflammation - Granulomatous, wound healing, Thrombosis, Embolism-

Infarction - Shock Bronchial asthma, COPD

Neoplasia: Definition of neoplasia. Differences between benign and malignant tumours; Metastasis; Carcinogenesis – Causes; Carcinoma of oral cavity – Causes; Aetiology of Carcinoma cervix – Screening investigations; Breast carcinoma – Risk factors

Systemic Pathology

RBC and Bleeding disorders:

Anaemia – Definition and classification, Haemolytic anaemia, Iron deficiency anaemia

WBC disorders: Leukaemia – acute and chronic causes.

Disease of the GIT: Peptic ulcer – causes; Carcinoma stomach – causes; Intestinal obstruction – causes; acute appendicitis – causes; Colonic carcinoma - causes

Diseases of Liver, Biliary tract and Pancreas: Jaundice – Cirrhosis – Definition and causes; Hepatitis – Types of viral hepatitis and transmission; Portal hypertension.

Endocrine System: Diabetes mellitus, Differences between type I and Type II diabetes mellitus, Complications of diabetes mellitus

Blood vessels: Atherosclerosis, Varicose veins.

The Heart: Heart failure, congenital heart diseases, Myocardial infarction.

Diseases of the Lung: Chronic obstructive pulmonary disease;

Asthma – pathogenesis; Pneumonia, Lung carcinoma

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Year -1 Semester -2 Practical
Course Code: BMIT - 205

Subject: Dark room and Processing Techniques

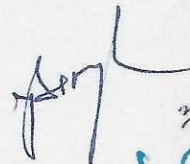
Practical:

- (i) Test to check the X-ray films and screen contact in the cassette
- (ii) Test to check light leakage in the cassette
- (iii) Processing of films in dark room
- (iv) To check the effect of safe light on exposed as well as unexposed X-ray film

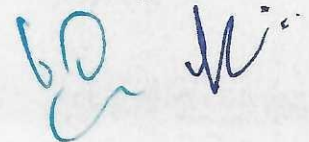

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Year -2 Semester -3 Paper -1
Course code - BMIT - 301

Subject: General positioning Part-1

1. Skeletal system:

a) Upper limb:

Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio ulnar joints and humerus.

Supplementary techniques. e.g., Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections.

b) Lower limb:

Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella and femur.

Supplementary techniques. stress view for torn ligaments, subtalar joint and talo-calcaneal joint, inter condylar projection of the knee, tibial tubercle, length measurement technique.

c) Shoulder girdle and thorax:

Technique for shoulder joint, scapular, clavicle, acromioclavicular joints, sternum, ribs, sterno-clavicular joint.

Supplementary projections and techniques. • Recurrent dislocation of shoulder.

• Traumatic dislocation of shoulder. • Cervical ribs.

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d) Vertebral column:

Technique for atlanto-occipital joint, cervical spine, cervicothoracic spine, thoracic spine, thoraco-lumbar spine, lumbosacral spine, sacrum and coccyx. Supplementary techniques to demonstrate:

- Scoliosis
- Kyphosis
- Spondylolisthesis
- disc lesion
- Union of spinal graft.

e) Pelvic girdle and hip region:

Technique for whole pelvis. Ilium, ischium, pubic bones, sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter. Supplementary techniques-

- Congenital dislocation of hips Epiphysis of femur
- Lateral projections for hip joints to show femoral head and neck relationship.

2. Lungs and Mediastinum:

Technique for routine projections

Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection.

Expiration technique. - Technique for pleural fluid levels and adhesions.

3. Abdominal viscera-

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

4. Radiography using mobile X-ray equipment-

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

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Year -2 Semester -3 Paper -2
Course Code: BMIT - 302

Subject: X-ray equipment- Part-1

1. Theory of computed tomography, generations of computed tomography
2. Dental radiography, general dental X-ray equipment, OPG equipment, mammography equipment.
3. Exposure timers, assessing the milliamperes, kilovoltages.
4. Measurement of the focal spot of An x-ray tube, testing the light-Beam Diaphragm, Indications of the failure of an x-ray Tube.
5. High tension cables.
6. Accessories and immobilization devices used in special situation like paediatric Radiography, Automatic pressure Injectors and monitoring device equipment.
7. Care and maintenance of equipment

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Year -2 Semester -3 Paper 3
Course code - BMIT - 303

Subject: Basic Principles of Different Imaging Modalities

1. Computed Tomography: Basic principles and historical development. CT detectors solid state detector, Photomultiplier tube detector and detector array.
2. Principles in formation of CT image, Digital image display. Different generation CT Spiral CT, Multi-slice CT Details of acquisition tomographic reconstruction techniques and CT artifacts.
3. Ultrasound Imaging: Basic Physics, Interaction of ultrasound with tissues, reflection, absorption refraction of ultrasound waves. Piezoelectricity, Transducer-structure of transducer
4. Doppler imaging- Principles, Continuous, Pulse wave USG, colour Flow imaging, USG artifact.
5. Nuclear Magnetic Resonance: magnetization properties, generation and detection of magnetic resonance signal. Basic principles in formation MR Image. Pulse sequence. Spin-echo sequence,
6. T1, T2 and proton density weighted image. Localization of MR signal and image reconstruction 3D Fourier transform image acquisition. Pulse sequences-SPIN ECHO types, Inversion Recovery STIR, FLAIR, Gradient coils, Echo Imaging.

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7. Main magnet, super conducting magnet, gradients coils, different types of RF coils used in MRI, safety and accident, MR Artifacts.

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Year -2 Semester -4 Paper 4
Course code - BMIT - 304

Subject: Radiation Biology, Radiation Detection

1. Biological effect of ionizing Radiation, Cell biology, Interaction of radiation with cells
2. Stochastic and deterministic effect of radiation induced cancer
3. Biological effects at organ system
4. Natural and man-made radiation.
5. Radiation detection and measurement
6. Gas filled detector-ionizations chamber, GM Counter
7. Scintillation detectors,
8. Thermo-luminescent detector. Personal monitoring- film badge, TLD badge
9. Radiation protections, units, aims and objectives.
10. ALARA Principles. protective devices lead apron, lead gloves mobile protective barriers.

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Year -2 Semester -3 Practical
Course code -MITP-305

Subject: Radiological Physics

1. To evaluate output of a radiographic room
2. To compare output of different X-ray units
3. To measure table top exposure of fluoroscopic unit
4. To study heel effect
5. To measure high contrast resolution in fluoroscopy
6. To check the alignment of radiation beam.
7. To verify inverse square law.

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Year -2 Semester -4 Paper-1
Course code - BMIT - 401

Subject: X-ray equipment-Part-2

1. Electric system and mains supply- electric system, generation of electrical energy, Distribution of electrical energy, use of electrical energy.
2. The rectification of High Tension, kilo voltage control and indication, filament circuit and control of Tube current.
3. Milliampere(mA) indication, mains voltage compensation, main supply and the x-ray set. High Tension generator - Rating of x-ray generators. The self-rectified, half wave, full wave rectified circuit.
4. Three phase six pulse 6 rectifier and 12 rectifiers. Three phase twelve pulse 12 rectifier circuit, High Frequency and medium Frequency generators, constant potential circuit, the falling Load generators.
5. Portable and mobile X-ray equipment, mains requirements, portable x-ray equipment, Mobile x-ray equipment, capacitor discharge Mobile equipment, x-ray equipment for operation theatres.
6. Fuses, switching and interlocks- switches and circuit broker, exposure switches and exposure timers, switching system, exposure switching.
7. Image intensifier tube, principles of image intensification,

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8. Television and digital image principle of television, television fluoroscopy,
9. Fluoroscopy modes of operation, Automatic Brightness control, standards. Fluoroscopic Tables.

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Year -2 Semester -4 Paper-2
Course code - BMIT - 402

Subject: General positioning Part-2

1. Radiography technique comprising of the complete
2. Radiography of skull and radiography of cranial bones; including special techniques for sella turcica, orbits, optic foramina, superior orbital fissure and inferior orbital fissure mandible, pituitary fossa, zygomatic arch.
3. Facial bones; Paranasal sinuses, Temporal bone and Mastoids.
4. Dental Radiography: Radiography of oral, extra oral and occlusal view.
5. Abdomen: Preparation of patient. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen. Technique to demonstrate foreign body, Imperforate anus (Invertogram).
6. Macro radiography: Principle, advantage, technique and applications.
8. High KV techniques principle and its applications.
9. Soft tissue Radiography including Mammography - its techniques, equipment, advancements and applications.
10. Localization of foreign bodies. Various techniques
11. Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.

12. 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.

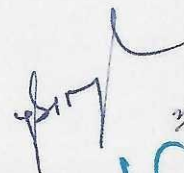
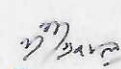


13. Trauma radiography/Emergency radiography

14. Neonatal and Paediatric Radiography,

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

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Year -2 Semester-4 Paper-3
Course code - BMIT - 403

Subject: Imaging Protocols in Scanning techniques in CT and MRI

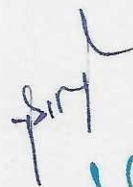
1. CT Protocols –general description about the basic parameters used in computed tomography scanning
2. Scan Mode – ultra fast, standard, high resolution, slice width, pitch.
3. Filming – window width, level
4. Ionic and nonionic contrast agents.
5. Clinical indication, patient positioning, patient preparation.
6. Scan protocols for routine and contrast enhanced. imaging of head, neck, shoulder, thorax, abdomen, spine, pelvis, cardio and extremities
7. MR Protocols - General Description about the basic parameters used in MR Imaging
8. FOV, matrix size, slice thickness, TR, TE, TI, Flip.
9. Concept of coronal, sagittal, transverse and oblique plane
10. Basic contrast mechanism, spin echo, gradient echo, ultra-fast gradient echo.
11. 3D acquisition modes, MR artifacts.
12. Indications and protocols for brain, neck, thorax, abdomen and pelvis.

13. Indications and imaging protocols for paramagnetic contrast enhanced MRI.

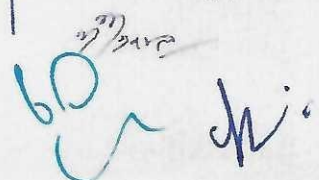

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Year -2 Semester-4 Paper-4
Course code - BMIT - 404

Subject: Basic Radiographic Techniques

1. Radiography general principles- Evaluation criteria, Positioning Accuracy: film Marker and patient identification: radiographic technique and imaging quality: density: contrast anode heel effect: radiation protection: positioning principles.
2. Radiographic image unsharpness: Geometric, Photographic, motional unsharpness over and under penetration, identification the causes radiographic contrast fogging, graininess mottle image artifacts, distortion.
3. Exposure factors, KVP, mAs focal spot, filtration, FFD, collimation, TABLE TOP, Grids, film screen factors, film speed, screen speed, system speed contrast manipulation of exposure factors, worked examples, programmed exposures image quality control- benefits of quality control, monitoring of the Auto processor.
4. Projection Radiography: basic geometric principles: the screen film cassette; characteristics of screen: characteristics of films, scattered radiation in projection Radiography.
5. High voltage technique - general principles - relationship to patient dose-change in contrast; radiographic image effects of exposure sharpness-relationship between kilovoltage and exposure time & tube current (mAs).

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6. Presentation for viewing of radiographs.
7. Image subtraction techniques, macro radiography- principles, magnification factor, quality of magnified image.
8. X-ray tube rating, application of macro radiography; other imaging modalities, rating, digital fluoroscopy, computed radiography, xero-radiography, photographic materials for CRT recording and film hard copy.
9. 3D and MRI reconstructions,
10. Duplicating film, duplicating equipment, procedure for duplication, quality of duplicated image.

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Year -2 Semester-4 Practical
Course code - BMIT- 405

Subject: General positioning

List of experiments on General positioning

1. Skull-AP, Lat. Base of Skull, Caldwell's, Town's, Sub-Mento-Vertical (SMV) View
2. View for optic foramina
3. Paranasal sinuses – Water's view
4. Mandible Series– Oblique view, AP View
5. Nasal bones – Lat.
6. Mastoids – Lateral oblique, town's view, Stenver's view, Schuller's projection
7. Temporomandibular joint – open and close mouth
8. Cervical spine – AP, Lat, open mouth projection, moving jaw
9. shoulder-AP, Axial view
10. Wrist -PA/AP Oblique, Ulnar flexion, Carpal tunnel view, Scaphoid Series
11. Calcaneum axial
12. Chest – PA, Lateral Decubitus, Lordotic view, Apicogram
13. Abdomen-AP (Erect); AP (Supine) Lat, KUB
14. Lumbosacral spine – AP/Lat/ oblique

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15. sternum – Lat. Oblique
16. Knee – AP, Lateral, Skyline view, Tunnels view
17. Scapula series



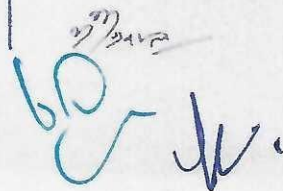
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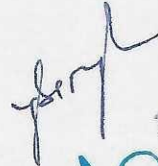
Year -3 Semester-5 Paper-1
Course code -BMIT-501

Subject: Advance Physics of Modern Imaging Modalities

1. Digital Projection Radiography- Charge couple device, Flat panel detector, Direct and indirect detector
2. Computer radiography
3. Digital mammography.
4. Display in digital imaging and further development.
5. Dual source CT, Virtual colonoscopy, Maximum Intensity projection(MIP), 3D
6. Calcium scoring
7. CT angiography – Cerebral, Carotid, Pulmonary, Abdominal (Triple phase), Upper and lower limbs.
8. Doppler sonography and advanced scanning technique and equipment and further development, 3-D USG, Colour flow imaging and USG contrast media.
9. Functional MRI perfusion and diffusion contrast magnetization. Image characteristics MR angiography and magnetization transfer, MR spectroscopy.
10. Bone densitometry - DEXA imaging.

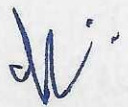

Dr. Anil Kumar


Dr. Ravi


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Year -3 Semester-5 Paper-2
Course code - BMIT - 502

Subject: Radiation Protection in Diagnostic Radiology

1. Introduction to Radiation protection.
2. Risk control in Medical exposure, estimation of effective doses, justification of exposure, optimization of Techniques, Paediatric exposure, avoidance of repeat exposure.
3. Radiation protection for a pregnant patient.
4. Patient dose and image Quality – factor affecting patient dose and image quality, factor influencing staff dose.
5. Diagnostic Radiology – Planning of Radiology department, design- Protective barrier, window, floor and ceiling, warning sign, equipment locations, layout, room size, shielding, illumination, control panels, waiting area.
6. Details of radiation Protection rules -2004 and guide lines issued by AERB. Requirement for Approval of plan lay out and licensing and registration of x-ray units, CT by AERB.
7. Radiation Dosimetry, Patient dose estimation in conventional and Radiography, fluoroscopy, Doses in Computed Tomography CTDI, bone mineral densitometry (BMD) and estimation of effective doses.
8. Operating theatre techniques-revision of procedure in collaboration with theatre staff-Checking of mains supply and function of apparatus.



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Year -3 Semester-5 Paper -3
Course Code - BMIT - 503

Subject: Radiological Physics Part-4

Image Quality Characteristics in Different imaging Modalities

1. Image characteristics and quality – image quality, image viewing condition, reflected, transmitted and emitted light images, noise, signal to noise- ratio, contrast, optimum contrast, sharpness, resolution.
2. X-ray image formation and contrast, Effect of kVp.
3. Radiographic Receptors- Image blurs, image noise, artifacts.
4. Film contrast characteristic – characteristic curve, optical density, film latitude, film fog
5. Blur, unsharpness.
6. Radiographic details- object location and magnification, motion blur.
7. Image quality in Computed tomography – contrast sensitivity, blur and resolution noise and artifacts.
8. Image quality in MRI – image details, image noise, noise sources, SNR, image acquisition time, procedures optimization.

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Year -3 Semester-5 Paper -4
Course Code - BMIT - 504

Subject: Research Methodology & Quality Control in Radiology

Research Methodology

1. Understanding research design:

Qualitative and quantitative methodologies – their differences and potential integration. Evaluation research and its potential for informing practice. Developing research questions and division methods for their investigation.

2. Analysis:

Analysis of qualitative and quantitative data. Utilization of appropriate software to assist in the retrieval of information and data analysis.

3. Clinical Audit:

Distinctiveness of research and audit processes in their function

4. Research skill and Management:

The role of evidence-based practice within health and welfare

Quality Control in Radiology

1. Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure, Reduction of film wastage

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and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance.

2. Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.
3. Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion, Artifacts of films and image recording. Monitor calibration.
4. 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 equipment; Record keeping and log book maintenance.



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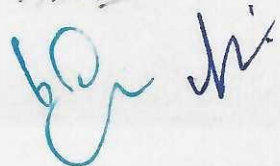
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Year -3 Semester-5 Practical
Course Code - MITP - 505

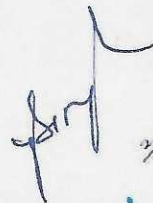
Subject: Practical on Radiation Protection

1. To survey the operation of an X-ray unit for deficiency in radiation safety.
2. To check the radiation protection level diagnostic fluoroscopic installation.
3. To check the integrity of lead apron using fluoroscopy
4. To survey the operation of Digital fluoroscopy unit for deficiency in radiation safety
5. To survey the operation of CT unit for deficiency in radiation safety.
6. To check protection of dark room for exposed films


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Dr. D. K. Singh

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Year -3 Semester -6 Paper-1
Course code - BMIT - 601

Subject: Special Investigation Procedures

1. Gastrointestinal Tract

- ☐ Barium Swallow, Barium Meal, Barium Meal follow through
- ☐ Barium Enema

2. Urinary Tract

- ☐ Intravenous urography, Retrograde pyelography, Cystography
- ☐ Micturating cystourethrography.

3. Biliary Tract

- ☐ Cholecystography
- ☐ T-Tube Cholecystography
- ☐ ERCP

4. Genital Tract

Hysterosalpingography

5. Sinogram

Fistulogram

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6. Salivary gland

Sialo gram

7. Angiogram

Cerebral

Carotid

Pulmonary

Peripheral

Venography

8. Aortogram

Ascending



Arch

Descending

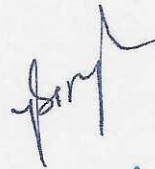
9. Angiocardiology

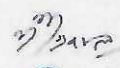
Calcium score

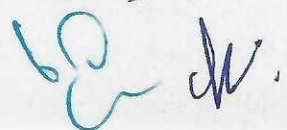
Coronary Angiography

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Year -3 Semester -6 Paper-2
Course code - BMIT - 602

Subject: Contrast Media used in Radiology and Imaging


Contrast media



1. Introduction of contrast media.
2. Positive and Negative contrast media.
3. Water soluble contrast media
4. Quantity of contrast agent used.
5. Properties of different contrast media.
6. Chemical composition of different contrast media.
7. Concentration and uses of contrast media.
8. Reactions of Contrast media.
9. Contrast induced Nephropathy.
10. Calculation of estimated Glomerular filtration rate


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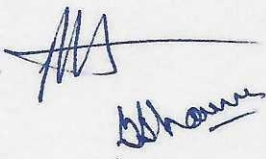





Year -3 Semester -6 Paper-3
Course code - BMIT - 603

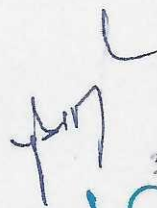
Subject: Radiotherapy and Radionuclide Imaging

1. Introduction to Radiotherapy
2. Radiation Therapy – Percentage depth dose, Factor influencing Percentage depth dose.
3. Brachytherapy
4. Teletherapy
5. Radionuclide decay terms and relationship nuclear transformation radionuclide production. Radionuclide used in nuclear medicine and radionuclide laboratories.
6. Radiation protection requirement in Nuclear medicine, special consideration in PET department Radioactive waste management.
7. Radiation measurement in nuclear medicine - Types of detectors Gas filled detectors, scintillation detector semiconductor detectors.
8. Radiation protection considerations in pregnant and breast feeding patient, Positron emission tomography.
9. Physics, techniques instrumentation and PET/CT.
10. Clinical application of radionuclide scanning.

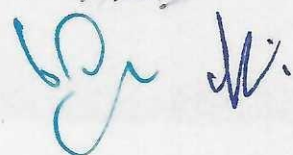


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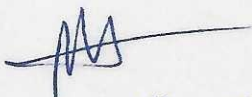




Year -3 Semester -6 Paper-4
Course code - BMIT - 604

Subject: Future Developments in Medical Imaging

1. Magnetic source imaging, MR Screening, MRCP.
2. Phase contrast MR imaging, Phase contrast CT Imaging
3. Digital subtraction techniques.
4. Dual energy x-ray Absorptiometry (DEXA).
5. Positron emission tomography (PET) CT.
6. Picture archiving and communication system (PACS), Tale-radiology
7. Hospital Information system and communication
8. Soft copy viewing
9. Component incompatibility, data storage requirement, work station design
10. Technical assessment
11. Any recent advances in CT, MRI, USG.


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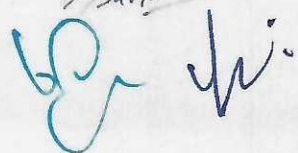
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Year -3 Semester -6 Practical
Course code - MITP - 605

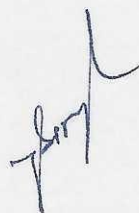
Subject: Practical in Radiography in Special Situations

1. Barium Series including double contrast examinations
2. Pyelography in normal adult, in child, diabetic patients and raised kidney function.
3. HSG with regular menstrual cycle.
4. Procedure to visualize biliary tract including T-tube
5. Barium enema in child with suspected Hirschsprung's disease
6. Choice and alternative of contrast agent
7. Use of fluoroscopy in chest.
8. Use of technique in Micturating Cystourethrography
9. Use of techniques in USG
10. Use of techniques in CT
11. Use of techniques in MRI



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103	Anatomy and Physiology Part - 1					
BMIT-104	Duties of Radiographer, Care & Preparation of Patients in the Radiology	50		25	75	100
MITP-105	Practical in Radiological Anatomy and Physiology		340 hr of clinical/ technical postings + total 60 hrs of experiments	25	75	100



Year - 1 Semester - 2

Course Code	Subjects	Theory Lectures in	Practical In Hrs	Marks allotted		
				Internal assessment	End semester Examination	Maximum marks

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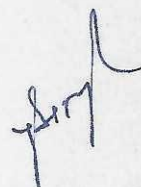
BSc MIT syllabus : Guru Gobind Singh Indraprastha University, 2021

		Hrs			on	
BMIT-201	Introduction to Basic Electronics, Computers & Biostatics	50		25	75	100
BMIT-202	Radiological Physics Part-2	50		25	75	100
BMIT-203	Dark room Part-2 Processing Techniques	50		25	75	100
BMIT-204	Human Anatomy, Physiology and Pathology relevant to Radiology Part -2	50		25	75	100
MITP-205	Practical in Dark room & Processing Techniques		340 hr of clinical/ technical postings + total 60 hrs of experiments	25	75	100

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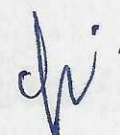




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Year - 2 Semesters - 3

Course Code	Subjects	Theory Lectures in Hrs	Practical In Hrs	Marks allotted		
				Internal assessment	End semester Examination	Maximum marks
BMIT-301	General positioning Part-1	50		25	75	100
BMIT-302	X-ray equipment Part-1	50		25	75	100
BMIT-303	Basic principles of different Imaging Modalities	50		25	75	100
BMIT-304	Radiation Biology & Radiation detection	50		25	75	100
MITP-305	Practical on Radiological		340 hr of clinical/	25	75	100

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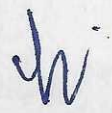
	Physics		technical postings + total 60 hrs of experiment s			
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Year - 2 Semesters - 4

Course Code	Subjects	Theory Lectures in Hrs	Practical In Hrs	Marks allotted		
				Internal assessment	End semester Examination	Maximum marks
BMIT-401	X-ray equipment Part-2	50		25	75	100
BMIT-402	General positioning Part-2	50		25	75	100
BMIT-403	Imaging Protocols in Scanning techniques in CT & MRI	50		25	75	100
BMIT-404	Basic Radiographic Techniques	50		25	75	100
MITP-	Practical on		340 hr of		75	100

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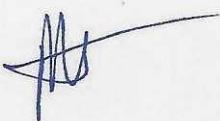
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405	General positioning		clinical/ technical postings + total 60 hrs of experiments			
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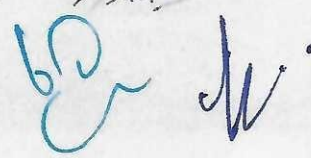
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Year - 3 Semesters - 5


Course Code	Subjects	Theory Lecture s in Hrs	Practical In Hrs	Marks allotted		
				Internal assessme nt	End semester Examinati on	Maximu m marks
BMIT-501	Advance Physics of Modern Imaging Modalities	50		25	75	100
BMIT-502	Radiation Protection	50		25	75	100
BMIT-503	Image quality characteristics in different imaging modalities	50		25	75	100
BMIT-504	Research Methodology & Quality Control in Radiology	50		25	75	100
MITP-	Practical on		340 hr of	25	75	100

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505	Radiation Protection	clinical/ technical postings + total 60 hrs of experiments			
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Year - 3 Semesters - 6

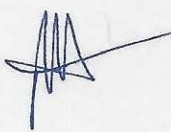

Course Code	Subjects	Theory Lectures in Hrs	Practical In Hrs	Marks allotted		
				Internal assessment	End semester Examination	Maximum marks
BMIT-601	Special Investigation Procedures	50		25	75	100
BMIT-602	Contrast Media used in Radiology & Imaging	50		25	75	100
BMIT-603	Radiotherapy and Radionuclide Imaging	50		25	75	100
BMIT-604	Future developments in medical imaging	50		25	75	100
MITP-605	Practical on special		340 hr of clinical/	25	75	100

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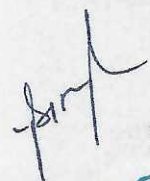
	investigation		technical postings + total 60 hrs of experiments			
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Criteria for Calculation of Internal Assessment of 25 marks

1. Class Examinations - 20
2. Attendance (above 90%) - 3
3. Subject assessment (candidate's conduct and extra-curricular participation) - 2

 
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