SYLLABUS PRIOR REVISION
FOR
BACHELOR OF SCIENCE
(RADIOLOGICAL IMAGING TECHNIQUES)

SUSHIL KUMAR THAKUR

Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0



BAREILLY INTERNATIONAL UNIVERSITY

FACULTY OF PARAMEDICAL SCIENCES

SYLLABUS

Bachelor of Science in Radiological Imaging Techniques (B.R.I.T)

(Session-2020-2021)

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

SYLLABUS
BACHELOR OF SCIENCE IN RADIOLOGICAL IMAGING TECHNIQUES
(B.SC. R.I.T)

FIRST SEMESTER
HUMAN ANATOMY-I

Total: 36 hours.

1. **Introduction to Human body as a whole**: Definition of anatomy and its divisions, Terms of location, positions and planes, Cell and its organelles, Epithelium-definition, classification, describe with examples, function, Glands- classification, describe serous & mucous glands with examples, Basic tissues – classification with examples.
2. **Locomotion and Support**
   Cartilage – types with example & histology, **Bone** – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of bones, vertebral column, inter vertebral disc, fontanelles of fetal skull, **Joints** – Classification of joints with examples, synovial joint (in detail for radiology), **Muscular system**- Classification of muscular tissue & histology, Names of muscles of the body.
3. **Cardiovascular System**
   Heart-size, location, chambers, exterior & interior, Blood supply of heart, Systemic & pulmonary circulation, Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial, artery, superficial palmar arch, femoral artery, internal iliac artery, Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses, Lymphatic systemcisternachyli& thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief.
4. **Nervous System**
   Neuron, Classification of NS, Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology), Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei, Blood supply of brain, Cranial nerves, Sympathetic trunk & names of parasympathetic ganglia.
5. **Sensory Organs**
   Skin: Skin-histology, Appendages of skin, ***Eye:*** Parts of eye & lachrymal apparatus, Extra-ocular muscles& nerve supply,
   Ear: parts of ear- external, middle and inner ear and contents
6. **Embryology**
   Spermatogenesis & oogenesis, Ovulation, Fertilization, Fetal circulation, Placenta

Reference Books:

1. William Davis, Understanding Human Anatomy and Physiology, McGraw Hill
2. Chaurasia, A Text Book of Anatomy
3. Ranganathan, T.S., A Text Book of Human Anatomy
4. Fattana, Human Anatomy, (Description and Applied), Saunder's& C P Prism Publishers, Bangalore
5. Ester. M. Grishcimer, Physiology & Anatomy with Practical Considerations, J.P. Lippin Cot

SUSHIL KUMAR THAKUR

Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

HUMAN PHYSIOLOGY-I

Total: 36 hours

1. General Physiology, Cell: morphology, Structure and function of cell organelles Structure of cell membrane Transport across cell membrane Intercellular communication Homeostasis.
2. Blood Introduction-composition & function of blood W.B.C., R.B.C., Platelets formation & functions, Immunity Plasma: composition, formation & functions, Plasma Proteins:-types & functions, Blood Groups- types , significance, determination Hemoglobin Haemostasis Lymph-composition, formation, circulation &functions.
3. Cardiovascular system, Conducting system-components, impulse conduction Heart valves Cardiac cycle- definition, phases of cardiac cycle Cardiac output- definition, normal value, determinants. Stroke volume and its regulation Heart rate and its regulation Arterial pulse, Blood pressure-definition, normal values, factors affecting blood pressure Shock-definition, classification, causes and features, Basic idea of ECG Cardiovascular changes during exercise.
4. Respiratory System: Mechanics of respiration Lung volumes and capacities Pulmonary circulation, transport of respiratory gases Factors affecting respiration Regulation of respiration-neural regulation, voluntary control and chemical regulation Hypoxia, Hypercapnoea, Hypocapnoea Artificial respiration Disorders of respiration- dyspnoea, orthopnoea, hyperpnoea, hyperventilation, apnoea, tachypnoea Respiratory changes during exercise.
5. Nervous system : Introduction, central and peripheral nervous system, functions of nervous system Reflexes- monosynaptic, polysynaptic, superficial, deep &withdrawal reflex Sense organ, receptors, electrical & chemical events in receptors Sensory pathways for touch, temperature, pain, proprioception & others Control of tone & posture: Motor mechanism: motor cortex, motor pathway: the descending tracts pyramidal & extra pyramidal tracts-origin, course, termination & functions. UMN & LMN paralysis.
6. Endocrinology: Physiology of the endocrine glands – Pituitary, Pineal Body, Thyroid, Parathyroid, Adrenal, Gonads, Thymus, Pancreas. Hormones secreted by these glands, their classifications and functions.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

BASIC PHYSICS INCLUDING RADIOLOGICAL PHYSICS-I

Total: 40 hours.

1. **Basic concepts**: Units and measurements-Force, work, power and energy-Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization-excitation-Binding energy-electron voltElectromagnetic radiation-Quantum nature of radiation-mass energy equivalenceFluorescence-electromagnetic spectrum.
2. **Electricity and magnetism**: Electric charges, Coulomb's law-Unit of charge-Electric potential, unit of potential-Electric induction, capacitance and Capacitors, series and parallel connection-electric current, unit, resistance, ohm's law, electric power, Joule's law. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS values and current and voltage, circuit containing LR, CR and LCR-Power factor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current.
3. **Electromagnetic waves**: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.
4. **Sound** - The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction. Doppler's effect, Ultrasonic wave, production of ultrasonic waves (piezo-electric effect) in ultrasonography. Use of principle of Doppler's effect in Diagnostic Radiology (e.g. Echo, blood flow measurement).

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

6. **Electronics** - Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers. Semiconductor diodes: p-n junction-properties forward and reverse bias, characteristics of p-n junction Rectifiers-Half-wave and full wave, ripple factor, Efficiency of HW and FW rectifiers. Filter circuits; Zener diode, regulated power supply. Transistors-Symbols, Transistor connections and characteristics, Transistor as an amplifier, load line analysis, operating point, types of amplifiers-voltage and power amplifiers. Feedback - negative feedback in amplifiers.

Reference Books:

1. K.Thalayan, Basic of Radiological Physics
2. K.Thalayan, Textbook of Radiological Safety
3. Rehani, Advance Medical Physics

* Latest editions of all the suggested books are recommended.

SUSHIL KUMAR THAKUR

Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

RADIOGRAPHIC AND IMAGING PROCESSING

Total: 40 hours.

1. Appreciation and application of all the factors listed below will enable the student/technologist to produce X-ray films of good quality and diagnostic value. The lectures to be linked with practical demonstration to illustrate the importance of all that goes to make up correct exposure conditions.
2. **Radiographic Film**: Structure of film emulsion-film characteristics (speed, base + fog, gamma, latitude)-effect of grain size on film response to exposure, interpretation of characteristics curve-Grain technology-Gelatin-Basic film types-Film formats and packing-Direct exposureduplitised films-Single coated emulsions-Films for specialized use-manufacturing process. Structure, properties of different parts, handling, film wrappings. Handling of exposed and unexposed films. Types, applications, advantages/limitations of different types, safe light requirements.
3. **Sensitometer:** Photographic density-characteristic curve-information from the characteristic curve-speed Vs definition. Storage of X-ray film.
4. **Control of scattered radiation**: Methods of minimizing formation of scatter radiation, effectiveness of grids-grid ratio-preventing scattered radiation, use of cones, diaphragm light beam devices and effectiveness of collimation in reducing effects of scatter. Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure.
5. **Intensifying screens**: Structure and functions, common phosphors used-types, screen mounting, care and maintenance of film screen contact. Intensifying factor-speed and detail-crossover effect-resolution-mottle-reciprocity-screen asymmetry-cleaning. New phosphor technology-influence of kilo voltage. Photo-stimulable phosphor Imaging.
6. **Cassettes**: Structure and function-Types-single, gridded, film holder-Design features and consideration with loading/unloading-Care and maintenance (cleaning).
7. **Photochemistry**: Principles: Acidity, alkalinity, pH, the processing cycle, development, developer solution. Fixing, fixer solution, washing, drying replenishment, checking and adjusting-latent image formation--nature of development-constitution of developer development time-factors in the use of developer. Fixers-constitution of fixing solution factors affecting the fixer-replenishment of fixer-silver conservation-Drying-developer and fixer for automatic film processor-rinsing-washing and drying. Replenishment rates in manual and automatic processing-Silver recovery-Auto and manual chemicals.
8. **Film Processing: manual processing**-care of processing equipment-automatic process or manual VS automatic processing-principles and typical equipment Microprocessor controlled-Cine processing-Daylight systems-Processing faults-maintenance. **Automatic Film Processor -** Functions of various components. Film roller transport-transport time, film feed system. Importance and relation to temp, fixed and variable time cycles. Care and maintenance (cleaning routine and methods of cleaning).
9. **Radiographic image**-components of image quality-unsharpness in radiographic image contrast of the radiographic image-distinctness of the radiographic image-size, shape and spatial relationships.
10. **Factors affecting Image Quality**: Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur. Radiographic illuminators and viewing conditions, visual acuity and resolution.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

11. **Presentation of radiographs**-opaque letters and markers-Identification of dental films preparation of stereo radiographs-viewing conditions.
12. **Monitor images**-Characteristics of the video image-television camera-imaging camera. Laser-light and laser-laser imaging-laser imagers-imaging plates-Dry cameras.
13. **Processing room**: location of the dark room-dark room illumination-equipment and layout-X-ray viewing room-Day light processing-Daylight handling-daylight systems with cassettes-without cassettes.

Dark Room

a. The processing area.
b. Dark room design, construction, illumination, entrance safe lighting-types.
c. Room storage, shelving of films.
d. Cleaning and maintenance. Dark Room Planning:
e. For A Small Hospital, for A Large Hospital Location of Dark Room and construction of Dark Room.
f. Ventilation, Wall Protection Entrance to Dark Room - Single Door, Double Door, Labyrinth.
g. Instruction to Staff, Dry Bench, Drawer, Cupboard.
h. Loading and Unloading Cassettes.
i. Hangers, Types of Hangers and Storage of Hangers
j. Wet Bench Cleanliness, Control of Dust, Dark Room Sink , Hatches and Drier
k. Safe Lights, Direct and Indirect, Uses, Factors Affecting Safelight Performance, Safelight Tests. Viewing Room, Film Dispensing.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

BIOCHEMISTRY

Total: 40hours.

1. Nutrition: Introduction, Composition of food, RDA, BMR, SDA, caloric requirement and Importance of nutrition Calorific values, Respiratory quotient, Physical activities (Energy expenditure), Role of carbohydrates, lipids and proteins in diet. Balanced diet and nutritional disorders.
2. Carbohydrates: Definition, classification, chemistry with examples, Structures, composition, sources, properties and functions of Monosaccharides, Disaccharides, Oligosaccharides and Polysaccharides. Glycosaminoglycan (mucopolysaccharides) metabolism (Glycogenesis, Glycogenolysis, Gluconeogenesis, Cori cycle), T.C.A cycle, glycolysis.
3. Lipids: Definition, classifications and general functions. Essential fatty acids and their importance, Metabolism- Oxidation of fatty acids, metabolism, oxidation of fatty acids, lipoproteins, Phospholipids, Cholesterol, lipolysis, lipogenesis, ketosis and ketone bodies metabolism.
4. Amino Acids; Definition, classification, essential and non essential aminoacids, metabolism (fate of ammonia) and urea cycle. Biological important pepetides, functions of proteins and amino acids. Enzymes: Definition, classification with examples, cofactors, Factors affecting enzyme action, isoenzyme and co-enzyme, Clinical importance of enzymes.
5. Biochemistry of connective tissue; Introduction, various connective tissue proteins: collagen, glycoproteins and proteoglycans, elastin- structure and associated disorders.
6. Vitamins: Definition, classification and functions, deficiency disorders, sources, RDA, digestion, absorption, transport and toxicity of individual vitamins.
7. Clinical Biochemistry - Relevance of blood and urine levels of Glucose, Urea, Uric acid, Calcium, Phosphates, Liver function tests, Renal function tests. Creatinine, pH and Bicarbonate. Lipid Profile-Tri - Glyceride, Cholesterol/HDL/LDL/ALDL Etc; Protein & Aggression, Glycosuria.
8. Nucleic acid: Function of DNA and RNA, chemistry, structure of DNA((Watson and Crick model),. Structure and functions of tRNA, rRNA, mRNA.Nucleotides and nucleosides.
9. Muscle Contraction - Contractile elements in muscle. Energy for muscle contraction
10. Biochemical harmones- Definition, Classification, Receptors, signal transduction, second messengers. Mechanism of Hormone action, effect of Insulin, Glucagon, Catecholamines, Thyroxine, Mineralocortocoids and Glucocorticoids. Diabetes mellitus: definition types & causes.
11. Biochemical organization of Human Cell - Introduction, cell structure, Cell membrane structure and functions, Types of Absorption of mechanism, organelles and their functions, Cytoskeleton Minerals metabolism- definition, sources, RDA, digestion, absorption, transport, excretion, functions and disorders- Calcium, Phosphate, Iron Magnesium, Fluoride, Selenium, Molybdenum, Copper. Phosphate, Calcium and Iron in detail.
12. Acid base balance: Acid, base and buffers, Ph, Buffer System of The Body, Biocarbonate buffer system. Role of Lungs and kidneys in acid base balance, acid base imbalance. Water balance-Body water and its distribution, Regulation of water balance-Role of ADH and Thirst centre. Electrolyte Balance- Osmolarity, Role of Aldosterone, Renin-Angiotensin System and ANF.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

SUBSIDIARY SUBJECT

BASIC COMPUTERS AND INFORMATION SCIENCE

1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
2. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).
3. Processor and memory: The Central Processing Unit (CPU), main memory.
4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
5. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
6. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.
7. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
8. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
9. Introduction of Operating System: introduction, operating system concepts, types of operating system.
10. Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
11. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet. Application of Computers in clinical settings.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

Practical

Human Anatomy-I Lab

1. Identification and description of all anatomical structures.
2. The learning of Anatomy is by demonstration only through dissected parts, slides, models, charts, etc.
3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominal viscera, face and brain).
4. Demonstration of skeleton- articulated and disarticulated.
5. During the training more emphasis will be given on the study of bones, muscles, joints, nerve supply of the limbs and arteries of limbs.
6. Surface anatomy: -surface land mark-bony, muscular and ligamentous.
7. Surface anatomy of major nerves, arteries of the limbs.
8. Points of palpation of nerves and arteries.

Human Physiology-I Lab

1. Examination of pulse, B.P., Respiratory rate.
2. Spirometery to measure various lung capacities & volumes, Respiratory rate, Tidal volume, IRV, IC, ERV, EC, residual volume on Spirometery.
3. Estimate of Haemoglobin, R.B.C., W.B.C., TLC, DLC, ESR count.
4. Blood indices, Blood grouping, Bleeding& Clotting time.

Biochemistry Lab

1. Preparation of buffers
2. Collection of specimen: Urine, blood, gastric juice, ascetic fluid
3. Tests for Carbohydrates (qualitative tests).
4. Tests for amino acids and Proteinds (qualitative tests)
5. Precipitation reactions of proteins.
6. Tests for lipids.
7. Study of enzyme activity
8. Urine analysis-test for normal and abnormal constituents
9. Centrifugation : Principle types, & applications.
10. Colorimetry and spectrophotometer-Principle and demonstration.
11. Estimation of blood/serum glucose, creatine, urea, cholesterol, total protein, bilirubin

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

SECOND SEMESTER
HUMAN ANATOMY-II

Total: 35 hours.

1. Spine and thorax: Back muscles - Superficial layer, Deep muscles of back, their origin, insertion, action and nerve supply. Vertebral column – Structure & Development, Structure & Joints of vertebra, Thoracic cage, Radiographic identification of bone and joints Applied anatomy.
2. Head and neck: Cranium, Facial Muscles – origin, insertion, actions, nerve supply, Tempo-mandible Joints – structure, types of movement.
3. Sensory system: Structure and function of Visual system, Auditory system Gustatory system Olfactory system Somato sensory system.
4. Respiratory system- Structure of upper and lower respiratory tract Thorax: Pleural cavities & pleura Lungs and respiratory tree Heart and great vessels Diaphragm
5. Digestive system Parts of digestive system Abdominal cavity – divisions Muscles of abdominal wall Liver Pancreas Spleen Alimentary canal Gall bladder Intestine (small & large).
6. Urinary and Reproductive system Urinary system Pelvic floor, innervations Kidney, Ureter, bladder, urethra Genital system – male and female Reproductive system of male Reproductive system of female.
7. Nervous system-Classification of nervous system with examples, Nerve –structure. Neurons classification. Simple reflex arc. Parts of a typical spinal nerve / Dermatome, CNS – disposition, parts and functions of Cerebrum, Cerebellum, Midbrain & brain stem, Blood supply & anatomy of brain.
8. Spinal cord- anatomy, blood supply, nerve pathways, Pyramidal, extra pyramidal system, Thalamus, hypothalamus, Structure and features of meninges, Ventricles of brain, CSF circulation, Development of nervous system & defects, Cranial nerves – (course, distribution, functions and palsy). Sympathetic nervous system, its parts and components, Parasympathetic nervous system: Applied anatomy.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

HUMAN PHYSIOLOGY II

Total: 35 hours.

1. Aviation, Space and Deep Sea Diving Physiology- Effects of Low Oxygen Pressure on the Body, Mountain Sickness, Effects of Acceleratory Forces, Artificial Climate, Weightlessness in Space, effects of High Partial Pressure of Gases on the Body, Hyperbaric Oxygen Therapy.
2. Nerve Muscle Physiology : Muscles- classification, structure, properties, Excitation contraction coupling Motor unit, EMG, factors affecting muscle tension, Muscle tone, fatigue, exercise Nerve –structure and function of neurons, classification, properties Resting membrane potential & Action potential their ionic basis All or None phenomenon Neuromuscular transmission Ionic basis of nerve conduction; Concept of nerve injury &Wallerian degeneration Synapses Electrical events in postsynaptic neurons Inhibition & facilitation at synapses Chemical transmission of synaptic activity Principal neurotransmitters.
3. Renal System: Physiology of kidney and urine formation Glomerular filtration rate, clearance, Tubular function, Water excretion, concentration of urine-regulation of Na+, Cl-, K+ excretion Physiology of urinary bladder
4. Digestive System: Digestion & absorption of nutrients gastrointestinal secretions & their regulation Functions of Liver & Stomach.
5. Male & female reproductive system, Male - Functions of testes, pubertal changes in males, testosterone - action & regulations of secretion. Female - Functions of ovaries and uterus, pubertal changes, menstrual cycle, estrogens and progestron - action and regulation.
6. Physiology of Exercise and Work - Neuromuscular activity human movement, physiological mechanism in movement, behavior, strength, endurance, & analysis of movement; Circulatory and respiratory response to exercise including effects on the heart, blood circulation, body fluid changes pulmonary ventilation, gas exchange and transport, etc.; Effects of exercise and work on other body functions ; Metabolic and environmental aspects of exercise and work-metabolism, energy requirement, efficiency of muscular work, nutritional aspects, heat and body temperature regulation and environmental factors ; Effects of Exercise training - endurance, fatigue and recovery; Fitness and health - age, sex, body type, race, stress and medical aspects of exercise.
7. Spinal Cord, Integration at spinal, brain stem, cerebellar, basal ganglion levels, along with their functions Spinal cord lesions- complete transaction & hemi section of the spinal cord Autonomic nervous system :features and actions of parasympathetic & sympathetic nervous system Hypothalamus Higher functions of nervous system Special senses- eye, ear, nose, mouth.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

BASIC PHYSICS INCLUDING RADIOLOGICAL PHYSICS –II

1. **Interaction of ionizing radiation with matter**-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation.
2. **Interaction of X and gamma rays:** Transmission through matter, law of exponential attenuation, half value layer, and linear attenuation coefficientcoherent scattering-photonuclear disintegration-Particle interactions. Interactions of X rays and Gamma rays in the body; fat-soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance.
3. Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.
4. Radiation intensity and exposure, photon flux and energy flux density.
5. LET, range of energy relationship for alpha, beta particles with X-Rays.
6. **X-ray tube**: historical aspects, construction of X-ray tubes, requirements for X-ray production(Electron source, target and anode material), tube voltage, current, space charge, early X-ray tubes(Coolidge tubes, tube envelop and housing) cathode assembly, X-ray production efficiency, advances in X-ray tubes, anode angulations and rotating tubes-line focus principle-space charge effect, tube cooling-Modern X-ray tubes-stationary anode, rotating anode, grid controlled X-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating Quality and intensity of x-rays-factors influencing them.
7. Grid controlled and high speed tubes, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation).Interlocking and X-ray tube overload protection.
8. Heat dissipation methods, tube rating, heat units, operating conditions and maintenance and Q.A procedures.
9. Filament current and voltage, X-ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits-high frequency generators-falling load generators, Capacitors discharge and grid control systems.
10. **X-ray generator circuits**: Vacuum tube diodes-semi-conductor diodes-transist or Rectification-half and full wave-self rectification-X-ray generator; filament circuitkilo Voltage circuit-single phase generator-three phase generator-constant potential generator-Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthing.
11. **Physical quantity, its unit and measurement:** Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVp, mA, mAS, Heat unit (HU.
12. **Radiation quantities and units**: Radiation intensity-exposure, roentgen, its limitations-kerma and absorbed dose-electronic equilibrium-rad, gray, conversion factor for roentgen to rad-quality factor-dose equivalent-rem, Sievert. Quality factor, dose equivalent, relationship between absorbed dose and equivalent dose.
13. **Radiation detection and measurements**: Principle of radiation detection-Basic principles of ionization chambers, proportional counters, G.M counters and scintillation detectors. Measuring system: free ionization chamber-thimble ion chamber-condenser chamber-secondary standard dosimeter-film dosimeter chemical dosimeter-Thermo Luminescent Dosimeter-Pocket dosimeter.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

CONVENTIONAL RADIOGRAPHY AND EQUIPMENT

Total: 35 hours.

1. **Production of x-rays:** X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x - ray tube; construction, working, methods of cooling the anode, rating chart and cooling chart; rotating anode x - ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x - ray tube; effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x - rays, inherent filter and added filter, their effect on quality of the spectrum.
2. **High tension circuits**: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment; mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of tube voltage, kV compensator; high tension selector switch, filament circuit, control of tube current, space charge compensation.
3. **Meters and exposure timers**: Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers, photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber based timers, integrated timer.
4. **Interlocking circuits:** Relays: description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.
5. **Control of scattered radiation**: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.
6. **Fluoroscopy:** Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid controlled x-ray tube.
7. **Care and Maintenance of X-ray equipment-** General care; functional tests; testing the performance of exposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

CLINICAL RADIOGRAPHY POSITIONING – I

Total: 35 hours.

1. Upper limb: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio ulnar joints and humerus supplementary techniques for the above. E.g. Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections.
2. **Lower limb:** Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella & 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
3. **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.
4. **Vertebral column**: Technique for atlanto-occipital joint, cervical spine, cervico thoracic spine, thoracic spine, thoraco- lumber spine, lumbo sacral spine, sacrum and coccyx. Supplementary techniques to demonstrate: Scoliosis, Kyphosis, Spondylolisthesis, disc lesion, Union of spinal graft.
5. **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.
6. **Skeletal survey:** Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.
7. **Skull:** Basic projections for cranium, facial bones, nasal bones and mandible. Technique for- Petrous temporal for mastoids. Internal auditory canal - Accessory nasal sinuses. Tempero - mandibular joint. Orbits and optic foramen - Zygomatic arches. Styloid process. Pituitary fossa, Jugular foramen.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

SUBSIDIARY SUBJECT

ENGLISH, COMMUNICATION AND SOFT SKILLS

1. Basic Language Skills: Grammar and Usage. Business Communication Skills. With focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation.
2. Teaching the different methods of writing like letters, E-mails, report, case study, collecting the patient data etc. Basic compositions, journals, with a focus on paragraph form and organization. Basic concepts & principles of good communication
3. Special characteristics of health communication, Types & process of communication verbal, non-verbal and written communication. Upward, downward and lateral communication. Therapeutic communication: empathy versus sympathy.
4. Communication methods for teaching and learning. Communication methods for patient education. Barriers of communication & how to overcome.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

Practicals

Human Anatomy-II Lab

1. Identification and description of all anatomical structures.
2. The learning of Anatomy is by demonstration only through dissected parts, slides, models, charts, etc.
3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominal viscera, face and brain).
4. Demonstration of skeleton- articulated and disarticulated
5. During the training more emphasis will be given on the study of bones, muscles, joints, nerve supply of the limbs and arteries of limbs.
6. Surface anatomy: -surface land mark-bony, muscular and ligament us. -surface anatomy of major nerves, arteries of the limbs.
7. Points of palpation of nerves and arteries.

Human Physiology-II Lab

1. NCV
2. EMG
3. Renal System
4. Digestive system
5. Male & female Reproductive system
6. Reflexes

Conventional Radiography and Equipment/ Clinical Radiography- positioning-I Lab

1. Radiographic positioning of all parts of the body.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

THIRD SEMESTER

RADIATION SAFETY IN DIAGNOSTIC RADIOLOGY -I

Total: 30 hours.

1. **Radiation Quantities and Units: Radiation**- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor - Flux- Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits –dose limits to public.
2. **Biological Effects of radiation**: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effects- stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

PATHOLOGY

Total: 40 hours.

1. Cell injuries – Reversible cell injury: Types, Sequential changes, Cellular swellings, vacuolation, Hyaline changes, Irreversible cell injury: Types of Necrosis &Gangrene. Difference between Reversible&Irreversible cell injury.Pathologic calcification: Dystrophic and Metastatic. Intracellular Accumulations - Fatty changes. Amyloidosis - Classification, Pathogenesis, Pathology including special stains.
2. Inflammation and Repair – Acute inflammation: features, causes, vascular and cellular events. Inflammatory cells and Mediators. Chronic inflammation: Causes, Types, Classification nonspecific and granulomatous with examples. Repair, Wound healing by primary and secondary union, factors promoting and delaying the process. Healing in specific site including bone healing.
3. Hypersensitivity: type and examples.HIV infection. AIDS- Aetiology, Modes of transmission, Diagnostic procedures, handling of infected material and health education.
4. Infectious diseases-Mycobacterial diseases: Tuberculosis, Syphilis. Viral diseases: Poliomyelitis, Herpes. Opportunistic infections. Parasitic diseases: Malaria, Filaria, Amoebiasis, Kala-azar, Hydatid cyst.
5. Circulatory Disturbances –Hyperemia/Ischemia and Haemorrhage. Edema: Pathogenesis and types. Chronic venous congestion: Lung, Liver, Spleen, Systemic Pathology Thrombosis and Embolism: Formation, Fate and Effects.Infarction: Types, Common sites. Shock: Pathogenesis, types, morphologic changes.
6. Growth Disturbances and Neoplasia: Definition, classification. Malignant Neoplasia: Local& Distant spread. Atrophy, Hypertrophy, Hyperplasia, Metaplasia. Benign and Malignant tumor. Carcinogenesis: Environmental carcinogens, chemical, viral, occupational. Benign & Malignant epithelialtumours Eg. Squamous cell carcinoma, Benign & Malignant mesenchymaltumours Eg: Fibroma, Lipoma, Neurofibroma. Nutritional Disorders –Protein energy malnutrition. Vitamin deficiency disorders, classification with specific examples.Genetic Disorders –Turner Syndrome, Down Syndrome, Klinefelter Syndrome.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

CONTRAST & SPECIAL RADIOGRAPHY PROCEDURES

Total: 45 hours.

For each of the examination the points listed below should be included:

1. Review the anatomy of the area.
2. State the clinical indication for the examination.
3. State contra indication if any for the examination.
4. Describe the preparation of the patient including the pre medication if appropriate.
5. Specify the type and quantity of contrast agent used.
6. Describe the method of introduction of the contrast agent.
7. Describe the series of projections taken during the examination.
8. Indicate the timings of the radiographs in relation to the administration of contrast agent.
9. Outline the practical problems and the way in which they may be overcome.
10. Explain the choice of exposure factor.
11. Detail the measures that should be taken for radiation protection.
12. Explain the after care of the patient.

Special radiographic procedures

1. Responsibility of Radiographer during Radiological Procedures.
2. Preparation of Patient for Different Procedures.
3. Contrast Media - Positive and Negative, Ionic & Non – Ionic
4. Adverse Reactions To Contrast Media and Patient Management
5. Emergency Drugs in the Radiology Department
6. Emergency Equipments In the Radiology Department
7. Aseptic technique
8. Indications, contraindications, basic techniques and relationship to other techniques of the following special procedures-:

a) **Gastrointestinal Tract**-Fluoroscopy, general considerations, responsibility of radiographers Barium swallow, pharynx and oesophagus, Barium meal and follow through, Hypotonic duodenography, Small bowel enema, Barium Enema routine projections for colon and rectum, colonic activators; double contrast studies; colostomy. Special techniques for specific disease to be examined, Water soluble contrast media - eg. gastrograffin studies

b. **Salivary glands:** Routine technique, procedure – sialography

c. **Biliary system:** Plain film radiography, Intravenous cholangiography, Percutaneous cholangiography, Endoscopic retrograde cholangio-pancreatography (ERCP), Operative cholangiography, Post-Operative cholangiography (T - tube Cholangiography)

d. **Urinary system:** Intravenous urography, Retrograde pyelography, Antegrade pyelography Cystography and micturatingcystouresthrography, Urethrography (ascending), Renal puncture

e. **Female reproductive system:** Hysterosalpingography.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

f. **Mammography:** Mammography: Basic views, special views, wire localization. Ductography.

g. **Respiratory system:** Bronchography: Awareness.

h. **Sinusography:** Routine technique and procedure.

i. **Tomography:** General principles. Estimation, selection of depth of layer. Layer thickness required for different examination. Spacing of layers. Types and advantages of various movements. Choice of tomographic movement- exposure factor. Sequential, horizontal and multi section tomography. Application of tomography to specific regions.

j. **Macroradiography:** General principles. Requirement. Equipment. Technique.

k. **Soft Tissue Radiography:** High and low kilo voltage technique; differential filtration. Non - screen technique - simultaneous screen and non -screen technique. Multiple radiography. Uses of soft tissue radiography.

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

m. **Localization of foreign bodies:** General location principles. Ingested; inhaled; inserted; embedded foreign bodies. Foreign bodies in eye. Preparation of the area to be investigated. Appropriate projection for all. Techniques to locate non-opaque foreign body.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

CLINICAL RADIOGRAPHY POSITIONING – II

Total: 30 hours.

1. **Dental Radiography**- Technique for intra oral full mouth.- Occlusal projections.- Extra oral projections including orthopantomography.- Supplementary techniques.
2. **Upper respiratory system**- Technique for post nasal airways, larynx, trachea, thoracic inlet, Valsalvamanoeuvre. - Phonation.
3. **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.
4. **Abdominal viscera**- Technique for plain film examination. - Projection for acute abdomen patients. - Technique to demonstrate: Foreign bodies, Imperforate anus.
5. **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.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

MODERN RADIOLOGICAL & IMAGING EQUIPMENT INCLUDING PHYSICS

TOTAL: 30 HOURS.

1. **Special radiological equipment:** Portable and mobile x-ray units, dental x-ray machine, skull table mammographic device - Technical aspects of Mammography; High Tension Generators, x-ray tubes-their types and advancements; Accessories; Resolution; Quality control; Application and role in medicine. , digital radiography equipment, digital subtraction techniques. Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of tomographic movements, Tomosynthesis, Stich radiography, Dual energy x-ray absorptionometry (DEXA) scan.
2. **Computed radiography**: its principle, physics & equipment. Digital Radiography. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications.
3. **Vascular Imaging Equipment:** Introduction, historical developments, Principle, scanned projection radiography, digital subtraction angiography, applications and definition of terms,
4. **Picture archiving and communication system (PACS)**

SUBSIDIARY SUBJECT
RESEARCH METHODOLOGY AND BIOSTATISTICS

Total: 30 hours

1. **Research Methodology -** Introduction to research methods, identifying research problem. Ethical issues in research, Research design. Types of Data, Research tools and Data collection methods. Sampling methods, developing a research proposal.
2. **Biostatistics -** Basics of Biostatistics, Introduction of Biostatistics, Measures of Morality, Sampling, Statistical significance, Correlation, Sample size determination. Statistics – Collection of Data - presentation including classification and diagrammatic representation – frequency distribution. Measures of central tendency; measures of dispersion. Theoretical distributions. Binomial, Normal, Sampling –necessity of methods and techniques. Chi. Square test (2 x 2). Hospital Statistics, Use of computerized software for statistics.

PRACTICAL
Modern Radiological &Imaging Equipment including Physics

1. Demonstration of basic procedures in all modern modalities.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

FOURTH SEMESTER

RADIATION SAFETY IN DIAGNOSTIC RADIOLOGY -II

Total: 35 hours.

1. **Radiation detection and Measurements**: Ionization of gases- Fluorescence and Phosphorescence - Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters- scintillation detectors – liquid semiconductor detectors – Gamma ray spectrometer. Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter – chemical dosimeter - Thermoluminescent Dosimeter. Pocket dosimeter-Radiation survey meter- wide range survey meter -zone monitor-contamination monitor - their principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography.
2. **Radiation protection**: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey –ALARA- personnel dosimeters (TLD and film batches) - occupational exposure.
3. **Radiation Hazard evaluation and control**: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

NEWER IMAGING TECHNIQUES INCLUDING PATIENT CARE-I

Total: 45 hours.

1. Interventional Radiography, Basic angiography and DSA: History , technique, patient care Percutaneous catherisation, catheterization sites, Asepsis, Guidewire, catheters, pressure injectors, accessories, Use of digital substraction- single plane and bi-plane. All forms of diagnostic procedures including angiography, angioplasty, bilary examination, renal evaluation and drainage procedure.
2. **Central Nervous System**: Myelography, Cerebral studies , Ventriculography
3. **Arthrography:** Shoulder, Hip, Knee, Elbow
4. **Angiography:** Carotid Angiography (4 Vessel angiography), Thoracic and Arch Aortography, Selective studies: Renal, SMA, Coeliac axis, Vertebral angiography, Femoral arteriography, Angiocardiography
5. **Venography:** Peripheral venography, Cerebral venography, Inferior and superior venocavography, Relevant visceral phlebography
6. **Cardiac catheterization procedures**:PTCA,BMV, CAG, Pacemaker, Electrophyiology.
7. **Microbiology**-Introduction and morphology - Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria. Growth and nutrition -nutrition, culture media, types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test, Sterilization and disinfection - principles and use of equipments of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, anti-septic and disinfectants. Introduction to immunology, bacteriology, parasitology, mycology.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

PHYSICS OF NEWER IMAGING MODALITIES

Total: 30 hours.

1. Computed Tomography its principle, various generations and advancements.
2. Magnetic Resonance Imaging- its principle, advancements and applications.
3. Ultrasonography, Color Doppler- its principle, advancements and applications.
4. Digital Radiography and Digital subtraction angiography equipment- principle, advancements and applications.
5. Fusion Imaging including PET-CT, PET- MRI.
6. Digital Mammography, DEXA equipment- principle, advancements and applications.
7. Tele radiology HIS,RIS and PACS.
8. Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy system.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

QUALITY CONTROL IN RADIOLOGY AND RADIATION SAFETY -I

Total: 35 hours.

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 programme at the radiological faculty level**: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging- image distortion for digital imaging devices. LASER printer calibration.
4. **Quality assurance programme tests**: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance – LASER printer - Light beam alignment; X-ray out-put and beam quality check; KVp check; Focal spot size and angle measurement; Timer check; mAs test; Grid alignment test; High and low contrast resolutions; Mechanical and electrical checks; Cassette leak check; Proper screen-film contact test; Safe light test; Radiation proof test; Field alignment test for fluoroscopic device; Resolution test; Phantom measurements - CT, US and MRI.
5. **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. SMPTE pattern.
6. **Maintenance and care of equipment**: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.
7. **Care and maintenance of diagnostic equipment:** General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

SUBSIDIARY SUBJECT

INTRODUCTION TO QUALITY AND PATIENT SAFETY

Total: 20 hours.

1. **Quality assurance and management** - The objective of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system. Concepts of Quality of Care, Quality Improvement Approaches, Standards and Norms, Quality Improvement Tools, Introduction to NABH guidelines.
2. **Basics of emergency care and life support skills** - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED). Initial recognition and response to heart attack and stroke are also considered part of BLS. The student is also expected to learn about basic emergency care including first aid and triage. Topics to be covered under the subject are as follows: Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing methods, One- and Two-rescuer CPR, Using an AED (Automated external defibrillator)., Managing an emergency including moving a patient. At the end of this topic, focus should be to teach the students to perform the maneuvers in simulation lab and to test their skills with focus on airways management and chest compressions. At the end of the foundation course, each student should be able to perform and execute/operate on the above mentioned modalities.
3. **Bio medical waste management and environment safety**- The aim of this section will be to help prevent harm to workers, property, the environment and the general public. Topics to be covered under the subject are as follows: Definition of Biomedical Waste, Waste minimization, BMW – Segregation, collection, transportation, treatment and disposal (including color coding), Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste, BMW Management & methods of disinfection, Modern technology for handling BMW, Use of Personal protective equipment (PPE), Monitoring & controlling of cross infection (Protective devices).
4. **Infection prevention and control** - The objective of this section will be to provide a broad understanding of the core subject areas of infection prevention and control and to equip AHPs with the fundamental skills required to reduce the incidence of hospital acquired infections and improve health outcomes. Concepts taught should include – Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)], Prevention & control of common healthcare associated infections, Components of an effective infection control program, and Guidelines (NABH and JCI) for Hospital Infection Control.
5. **Antibiotic Resistance-** History of Antibiotics, How Resistance Happens and Spreads, Types of resistance- Intrinsic, Acquired, Passive, Trends in Drug Resistance, Actions to Fight Resistance, Bacterial persistence, Antibiotic sensitivity, Consequences of antibiotic resistance, Antimicrobial Stewardship- Barriers and opportunities, Tools and models in hospitals.
6. **Disaster preparedness and management**- The objective of this section will be to provide knowledge on the principles of on-site disaster management. Concept should include- Fundamentals of emergency management, Psychological

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: CN=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113E6B1692708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

Resource management, Preparedness and risk reduction, Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction), information management, incident command and institutional mechanisms.

ENVIRONMENTAL SCIENCES

1. **General-**Biotic and a biotic environment, Adverse effects of Environment Pollution, Control strategies
2. **Water Pollution:** Water Quality standards for potable water, Impurities in water and their removal, Defluoridation, Self purification of streams
3. **Air pollution-**Source of air contaminants, Adverse effects on human health, Measures to check air pollution, Greenhouse effect, Acid Rain, Ozone depletion
4. **Biomedical Waste Management-** Introduction to Bio-medical waste, Types of bio-medical waste, Collection of bio-medical waste, Treatment and disposal of bio-medical waste
5. **Solid waste Management -** Introduction to solid waste, Its collection and disposal, Sanitary land-filling, Vermin-composting, Hazardous waste management
6. **Land Pollution -** Soil conservation, Land erosion
7. **Ecology -** Busies of species, Biodiversity, Population dynamics, Energy flow, Ecosystems

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

FIFTH SEMESTER

PHYSICS OF ADVANCED IMAGING TECHNOLOGY -1

Total: 35hours.

1. **Basic Computed Tomography-** Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display.
2. **Advanced Computed Tomography** - Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose, patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography – (Aortogram, selective angiogram head, neck and peripheral) image documentation and Filing, maintenance of equipment and accessories.
3. **Ultrasonography** - Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing. Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam. Ultrasound display modes: A, B, M. Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety. Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

RADIOGRAPHIC TECHNIQUES IN ADVANCED IMAGING TECHNOLOGY –I

Total: 30 hours.

1. **Ultrasonography/ Doppler studies:** Techniques of sonography-selection- Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols clinical applications display methods –quality image reproducible extend – biopsy procedures, assurance to patients.2. CT scan studies acquisition/ protocols /techniques: CT of head and neck – thorax – abdomen – pelvis – muscular skeletal system – spine – PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.
2. **MRI Scanners:** Methods of MRI imaging methods – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

NEWER IMAGING TECHNIQUES INCLUDING PATIENT CARE-II

Total: 45 hours.

1. **Patient care in Medical Imaging Department** - Patient management is based on team work, it is essential that the student should appreciate the technologist's role and that the importance of co-operation with wards and other departments. The students should be attached to wards or the accident and emergency department for a definite training period.
2. **Hospital procedure** - Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.
3. **Care of the patient** - FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients (for example clean linen and receptacles , nursing care; temperature pulse and respiration; essential care of the patient who has a tracheotomy; essential care of the patient who has a colostomy; bedpans and urinals; simple application of a sterile dressing.
4. **First aid** - Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons.
5. **Infection** - Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc.
6. **Principles of asepsis** - Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filament swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department (for study by radio imaging students only)
7. **Departmental procedures including Drugs in the department** - Department staffing and organizations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department; appointments, organizations, minimizing waiting time, out-patient and follow-up clinics, stock taking and stock keeping. Classification, labeling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti depressive, anti-hypertensive etc.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

HOSPITAL PRACTICE AND CARE OF PATIENT – I

Total: 30 hours.

1. Hospital staffing and administration, records, professional, ethics, co-operation with other staff and departments, Departmental organizations. Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non-English speaking patients. Understanding patient needs - patient dignity of inpatient and out patients. Interaction with the patient's relatives and visitors.

2. Methods of effective communication - verbal skills, body language, professional appearance, visual contact etc. Elementary personal and departmental hygiene, dealing with receptacles, bed pans and urinal etc. General preliminaries to the exam. Moving chair and stretcher, patient. Unconscious patient, general comfort and reassurance for the patient. Vital signs and oxygen - patient's Haemeatasis status. Body temp, respiratory rate, pulse, blood pressure, oxygen therapy, oxygen devices, Chest tubes and lines.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

QUALITY CONTROL IN RADIOLOGY AND RADIATION SAFETY -II

Total: 35 hours.

1. **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. SMPTE pattern.
2. **Maintenance and care of equipment**: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.
3. **Care and maintenance of diagnostic equipment:** General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.

SUBSIDIARY SUBJECT
MEDICAL TERMINOLOGIES AND RECORD KEEPING

Total: 20 hours.

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

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

SIXTH SEMESTER

PHYSICS OF ADVANCED IMAGING TECHNOLOGY -II

Total: 30 hours.

1. **Advanced technique & instrumentation of MRI**

a. Basic Principles: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image.

b. Pulse sequence : Spin echo pulse sequence – turbo spin echo pulse sequence - Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences.

c. MR Instrumentation: Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers.

d. Image formation: 2D Fourier transformation method – K-space representation – 3D Fourier imaging – MIP.

e. MR contrast media – MR angiography – TOF & PCA – MR Spectroscopy – functional MRI

REGULATORY REQUIREMENTS IN DIAGNOSTIC RADIOLOGY

Total: 30 hours.

1. **Regulatory Bodies & regulatory Requirements**: International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements.

2. **Role of Radiographer in Planning, QA & Radiation Protection:** Role of technologist in radiology department - Personnel and area monitoring., Setting up of a new X-Ray unit, staff requirement, AERB specifications for site planning and mandatory guidelines – Planning of X-ray rooms, dark rooms – Inspection of X-Ray installations - Registration of X-Ray equipment installation- Certification -Evaluation of workload versus radiation factors – Occupational exposure and protection Tools/devices. ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDT Act and guidelines.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

HOSPITAL PRACTICE AND CARE OF PATIENT –II

Total: 30 hours.

1. First aid - shock, electrical shock, haemorrhage, burns, Asphyxia, fractures, loss of consciousness. Emergency treatment to the collapsed patient. Artificial respiration and resuscitation. Preparation of patient for general and special radiological examinations. Supervision of patients undergoing special examination. Administration of drugs and contrast media. Aseptic and sterile procedures. Handling of infections patients in the department or in the ward.
2. Regulation of dangerous drugs. Trolley set up for special x-ray examinations, Radiation hazardous and protective measures.

RADIOGRAPHIC TECHNIQUES IN ADVANCED IMAGING TECHNOLOGY –II

Total: 30 hours

1. **MRI Scanners:** Methods of MRI imaging methods – Head and Neck, Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures - reconstructions- 3D images - MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer.

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0

SUBSIDIARY SUBJECT

MEDICAL LAW AND ETHICS

Total: 25 hours.

1. Medical ethics - Definition - Goal - Scope
2. Introduction to Code of conduct
3. Basic principles of medical ethics – Confidentiality
4. Malpractice and negligence - Rational and irrational drug therapy
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia
7. Organ transplantation
8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
9. Professional Indemnity insurance policy
10. Development of standardized protocol to avoid near miss or sentinel events
11. Obtaining an informed consent

SUSHIL KUMAR THAKUR
Digitally signed by SUSHIL KUMAR THAKUR
DN: C=IN, O=Personal, PostalCode=302033, S=Rajasthan, SERIALNUMBER=C973379113FC8D793F2708FC9D687F06B89F4196B9325326C00EECB6FEC22CC0, CN=SUSHIL KUMAR THAKUR
Reason: your signing reason here
Location: your signing location here
Date: 2024.09.19 17:37:32+05'30'
Foxit PDF Editor Version: 2024.1.0