M. Voc. Medical Imaging Technology
(02 Years Duration) with 04 Semesters

SEMESTER - I

Component	Title of The Paper	Credits
Theory		
Paper – 1	Human Anatomy & Physiology (Theory)	04
Paper – 2	General and Radiological Physics (Theory)	06
Paper – 3	Advanced Physics of Radiology & Imaging(Theory)	06
Paper – 4	Radiological & Imaging Procedures (Theory)	06
Practical		
Paper – 1	Human Anatomy & Physiology (Lab)	02
Paper – 2	General and Radiological Physics (Lab)	02
Paper – 3	Advanced Physics of Radiology & Imaging(Lab)	02
Paper – 4	Radiological & Imaging Procedures (Lab)	02
	Total Credit	**30**

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 1) HumanAnatomy & Physiology (Theory)

Credits – 04

HUMAN ANATOMY&PHYSIOLOGY

Unit-I Skeletal System:

Bones—Types, Structure and Growth Division of the Skeleton

Appendicular skeleton Axial skeleton

Names of Bones and their parts Joints Classification

Types of movements with examples, **Sensory organs** Structure and Functions

Unit-2 Digestive System:

Components of digestive system Alimentary tube

Anatomy of organs of Digestive Tube-Mouth

Tongue Tooth

Salivary Glands,Liver

Biliary apparatus Pancreas, Intestine

Digestion and Absorption of food and it excretion

Role of Bileindigestion and excretion Liver function

Unit-3 Respiratory System:

Anatomy of gastrointestinal tract, components of G I tracts, Oral cavity, Tonsils, Pharynx, Alimentary canal, Salivary glands .Anatomy of Digestive system, Stomach, Small & Large intestine, Liver, Gall bladder, Pancreas, Spleen, Biliary apparatus. Respiratory system Larynx Bronchi Lungs Cardio vascular System: Anatomy and Physiology of Heart, Arteries and Veins Circulation- System atic and pulmonary Chambers, Applied Anatomy.

Unit-4 Central Nervous System:

Anatomy of Nervous system, structure of Neurons, parts, Classification, of CNS, Structure of Human brain, (HIND,MID & FORE BRAIN), Location, functions, & covering of brain, Spinal cord structure, functions, PNS, ANS, Sense organs, spinal & Cranial nerves. Brain Spinal Cord and endocrine system, Various glands, structure, functions, blood supply, Applied Anatomy.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 1) Human Anatomy & Physiology (Practical)

Credits – 04

HUMAN ANATOMY&PHYSIOLOGY

- Demonstration of Skeletal System, Organs of Body, Sensory Organs
- Study of Digestive Systems organs
- Handling and demonstration of alimentary canal, Stomach, Liver, Pancreas, Gall bladder, Lungs, Thyroid, pitutary, Adrenal glands, Heart and Trachea

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 2) General and Radiological Physics (Theory)

Credits – 06

Unit 1. Electrical charges, potential difference, current and resistance. Ohms Law for electrical circuit, , conductors, semiconductors, insulators, power, ammeter and voltmeter. Electromagnetism, , Capacitor, capacitance.

Unit 2. Generation of electrical energy, AC/DC, Polyphase supply, Distribution of electrical energy, uses of electrical energy, Current loads & power loss, Uses of electricity in Hospitals, Safety rules for Radiographers. X ray Circuit components, High tension transformers, Main Voltage Compensation, High tension switches, Stabilizers and UPS. Fuses, Switches, Earthing, High tension cables, construction & design. Rectification, Types of Rectifiers, X-ray circuits, Filament circuits, High voltage circuits. Tube rating, Types of Generators, Capacitor discharge generator, Battery Powered generator, Medium frequency & High frequency generator.

Unit 3. Switches, Circuit breakers, Primary & Secondary switches, Exposure 12 switching and its application. Interlocking Circuits, Regulating and safety devices, Magnetic relay, Thermal relay switches, Interlock in Tube Circuit and overload interlocks. Exposure timers, Timing systems, Electronic timer, Ionization timer, Photo timer, Synchronous timer and impulse timer. Devices improving radiographic quality- Cone, Cylinder, Collimator, Grid, Filter. Portable X-Ray Equipments, Mobile X-Ray Equipments, Capacitor Discharge Mobile Equipment, Cordless Mobile Equipments, X-Ray Equipments for the Operating Theatre, Mobile Image Intensifier units.

Unit 4. Interaction of ionizing radiation with matter-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation. Interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, half value layer, and linear attenuation coefficient-coherent scattering-photonuclear disintegration-Particle interactions. Interactions of X rays and Gamma rays in the body; fat-soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance. Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number. 5.

Unit 5. Radiation intensity and exposure, photon flux and energy flux density. LET, range of energy relationship for alpha, beta particles with X-Rays. 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 angulation 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. 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.

Unit 6. Heat dissipation methods, tube rating, heat units, operating conditions and maintenance. 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.

Unit 7. X-ray generator circuits: Vacuum tube diodes-semi-conductor diodes-transistor Rectification-half and full wave-self rectification-X-ray generator; filament circuit-kilo Voltage circuit-single phase generator-three phase generator-constant potential generator-Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthing. 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). Radiation quantities and units: Radiation intensity-exposure, roentgen, its limitations- kerma and absorbed dose-electronic equilibrium-rad, gray, conversion factor for roentgen to radquality factor-dose equivalent-rem, Sievert. Quality factor, dose equivalent, relationship between absorbed dose and equivalent dose.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 2) General and Radiological Physics (Lab)

Credits – 04

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1)X-Ray tubes and accessories, general features.

2) Portable X-Ray Equipment.

3) Image intensifier, its features, spot film.

4) Radiation protection devices

5) Effects of kV and mAs.

6) Maintenance of X-ray equipment and accessories.

7) Mammography X-Ray tube

8) Dental X-Ray unit.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 3)Advanced Physics of Radiology & Imaging (Theory)

Credits – 06

Unit 1. Physics of Imaging including conventional radiography, fluoroscopy, computed radiography and flat panel DR imaging.

Unit 2. 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.

Unit 3. 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 processingtechniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose Index.

Unit 4. Mammography:- Digital mammography including cones compression device, biopsy system with all routine and digital mammography procedures.

Unit 5.MRI- Basic Principles: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image.

a. 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

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

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

d. MR Spectroscopy – functional MRI

Unit 6. Ultrasonography : Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam. 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. Ultrasound display modes: A, B, M Real-time ultrasound: Doppler Ultrasound, Doppler artifacts, vascular sonography.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 3)Advanced Physics of Radiology & Imaging (Lab)

Credits – 04

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1. Knowledge of Physics used in X-rays.
2. Working of X-ray Machine.
3. Knowledge of Physics used in CT Scan.
4. Working of CT Scan Machine.
5. Knowledge of Physics used in MRI.
6. Working of MRI Machine.
7. Knowledge of Physics used in USG
8. Working of USG Machine

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 4)Radiological & Imaging Procedures (Theory)

Credits – 06

Unit 1. Special Radiographic/Radiological procedures; Selection of Fluoroscopy Equipment, general considerations, responsibility of radiographers. Patient Preparation, Indications Contraindications Technique Post Care and Preparation of Drug Trolley/Tray, Radiation Safety. Contrast Media - Positive and Negative, Ionic & Non – Ionic, Adverse Reactions To Contrast Media and Patient Management, Emergency Drugs in the Radiology Department ,Aseptic technique for the following procedures.

Unit 2. Gastrointestinal Tract: 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. Including water soluble contrast media - eg. gastrograffin studies.Including CT,US and MRI Special Imaging Techniques.

Salivary glands: Routine technique, procedure - sialography. Biliary system: Plain film radiography. Intravenous cholangiography. Percutaneous cholangiography, Endoscopic retrograde cholangio-pancreatography (ERCP). Operative cholangiography, Post-Operative cholangiography (T-tube Cholangiography). Including CT, US and MRI Special Imaging Techniques.

Unit 3. Urinary system: Intravenous urography, Retrograde pyelography. Antegrade pyelography. Cystography and micturating cystouresthrography. Urethrography (ascending) Renal puncture. Including CT,US and MRI Special Imaging Techniques.

Unit 4. Reproductive system: All the Techniques relating to Male and Female reproductive system including Hysterosalpingography. Breast Imaging: Mammography: Basic views, special views, wire localization. Ductography, Tomosynthesis, ABVS, Various Biopsy Techniques including Prone Table Biopsy, CT, US and MRI Special Imaging Techniques. Respiratory system: - Bronchography: Including CT,US and MRI Special Imaging Techniques. Sonography:Routine technique and procedure.

Unit 5. Central Nervous System: Myelography. Cerebral studies.Ventriculography etc including CT, US and MRI Special Imaging Techniques. Arthrography: Shoulder, Hip, Knee, Elbow joints etc including CT, US and MRI Special Imaging Techniques. Angiographic Studies: Carotid Angiography (4 Vessel angiography). Thoracic and Arch Aortography. Selective studies: Renal, SMA, Coeliac axis. Vertebral angiography. Femoral arteriography. Angiocardiography, Peripheral angiography. Venography: Peripheral venography.Cerebral venography.Inferior and superior venocavography.Relevant visceral phlebography.

M. Voc. Radiology & Imaging Technology (M. Voc. - RIT)

SEMESTER-I

(Paper - 4)Radiological & Imaging Procedures (Lab)

Credits – 04

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1. Introduction of basic anesthetic instruments & anesthetic procedures.
2. Contrast Media
3. Plain Radiography
4. Intravenous Urogram
5. Mammography
6. Dental Radiography
7. X-ray production
8. Film processing
9. Sensitometry
10. Radiographic Image
11. Automatic film processor