

**ANDHRA PRADESH PARA MEDICAL BOARD  
HYDERABAD**

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**Syllabus for  
DIPLOMA IN DARK ROOM ASSISTANT COURSE  
(TWO YEARS COURSE)**

**B.N.S. Kumar  
Secretary**

In view of representation from the Faculty in Government colleges, in State of AP.  
 The Syllabus for the 1<sup>st</sup> year in all Para medical courses is modified accordingly the  
 modified Syllabus for 1<sup>st</sup> year is kept on website.

<b>DIPLOMA IN DARKROOM ASSISTANT COURSE (TWO YEARS COURSE)</b>	
<b>Syllabus for First Year</b>	
<b>Paper-I</b>	<p><b><u>BASIC HUMAN SCIENCES</u></b></p> <p>A) Basics of Anatomy            B) Basics of Physiology            C) Basics of Bio-chemistry            D) Basics of Bio-statistics</p>
<b>Paper-II</b>	<p><b><u>PHYSICAL SCIENCES</u></b></p> <p>A) Basics of Pathology            B) Basics of Blood Banking            C) Basics of Microbiology            D) Basics of Central sterilization.</p>
<b>Paper-III</b>	<p>A) Hospital awareness,            B) Familiarization of different tables/tubes in surgical dept. Surgical Awareness, Preparation of patient for surgery.            C) Patient related services.            D) Communication &amp; Computer Skills,            Audio and Visual Aids</p>

**DIPLOMA IN DARKROOM ASSISTANT COURSE  
(TWO YEARS COURSE)**

**Syllabus for Second Year**

**Paper-I**

- A) Radiation Hazards, Protection Preventive Measures.
- B) Dark Room Procedure,
- C) Regional Radiography, Fundamentals of X – Ray Equipments, Modified X – Ray Equipments For Special Purpose.
- D) Special Diagnostic Procedures

**Paper-II**

- A) Radiographic Techniques & Radiographic Anatomy, Radiological Physics & Equipment.
- B) Positioning Radiography & Contrast Procedure
- C) First Aid , Basic Nursing, Handling of Patients
- D) Magnetic Resonance Imaging

**Paper-III**

- A) Ultra Sound Imaging, Interventional Procedures & Angiography
- B) Basic & Advanced CT Imaging
- C) Basic & Advanced MRI Imaging
- D) Instrumentation Study, Instrument Measurement & Critical Care Equipment.

# 1<sup>st</sup> YEAR

## PAPER-I

### Basics of Anatomy & Physiology

#### **Basics of Anatomy**

1. Introduction to Human Anatomy
2. Cell- Tissues Properties, Different Tissues
3. Digestive System & Hepatobiliary System
4. Respiratory System
5. Cardio Vascular System
6. Lymphatic System
7. Bones and Joints
8. Nervous System
9. Endocrine System
10. Sense Organs
11. Excretory System
12. Reproductive System

#### **Basics of Physiology**

1. Introduction to Human Physiology
2. Blood
3. Cardio Vascular System
4. Lymphoid System
5. Digestive System
6. Respiratory System
7. Nervous System
8. Endocrine System
9. Excretory System
10. Reproductive System
11. Sense Organs

## Basics of Bio – Chemistry

1. Introduction to Basics of Bio-chemistry including code of ethics for Medical Lab Technicians and Medical Lab Organization.
2. Reception, Registration and bio-chemical parameters investigated.
3. Glassware and plastic ware used in a bio-chemical laboratory.
  - a. **Glassware:**
    - 1) Types of glass and composition.
    - 2) Types of glassware used, their identification, application & uses.
    - 3) Cleaning, drying, maintenance and storage of glassware.
  - b. **Plastic ware: Brief outline**
4. Instrumental methods of Bio-chemical analysis.
  - a. **Colorimetry :**

Visual and photoelectric methods, instrumentation, principle & laws involved construction, operation, care and maintenance, applications.
  - b. **Spectrophotometry**

Principle and theory, types, construction, & applications
5. Basic lab operations like
  - a. **Separation of solids from liquids**
    1. Centrifugation: Principle, Different types of centrifuges care and maintenance, applications.
    2. Filtration using funnel.
    3. Weighing : Different types of balances used, care and maintenance.
    4. Evaporation
    5. Distillation
    6. Refluxing
    7. Drying different salts and dessication.

6. Water Chemicals and related substances
  - a. Purity of chemicals
  - b. Corrosives
  - c. Hygroscopic Substance
7. Prevention, Safety and first aid in lab accidents.
8. Collection of Specimens
  - a. **Blood:** Types of Specimens, Collection, Precautions during collection processing and preservation.
  - b. **Urine:** Types of Specimens, Collection, Precautions during collection, Processing and Preservation.
9. Urine biochemical parameters.
10. Units of measurements
11. **Solutions** : Types based on solute and solvent, Types based on method of expressing concentration, calculations.
12. **Carbohydrates:** Definitions, Biological importance, Acid value, iodine value, saponification value.
13. Amino acids and Proteins Definition, Biological importance, Classification, Qualitative tests.
14. **Diagonistic tests** : Blood sugar, Glucose tolerance test, Blood urea, Serumuric acid, Serum creatinine.
15. **Vitamins and Minerals**
  - a. **Vitamins:**  
Water Soluble vitamins, Fat Soluble vitamins, Sources, Daily requirements, Deficiency diseases.
  - b. **Minerals :**  
Sources, Daily requirements, Deficiency diseases.

# Paper-II

## Basics of Pathology

### Introduction to Pathology in brief

1. Urine – Analysis – Physical Examination – specific gravity PH, reaction, colour.  
Chemical Examination – Sugar Albumin, bile salts, bile Pigments etc.  
Microscopic, Sediment for RBC, WBC, Epitheleal cells, casts, crystals, parasites.  
Preparation of Reagents, procedure and principle of tests.
2. **Sputum Analysis** – Physical Examination, Preparation and staining smear for Microscopic Examination.
3. **Semen Analysis** – Physical Examination Microscopy – counting, motility, staining, Morphology, abnormal and normal forms.
4. **Body Fluids** – Differential count of Peritoneal, pericardial, pleural fluids and CSF, charging chamber, Identifying and counting the cells.

# Basics of Microbiology

## I. Introduction to Microbiology in brief

Definition,  
History

## II. Microscopy

- a) Principle working and maintenance of compound Microscope.
- b) Principle of Fluorescent microscope, Electron Microscope, Dark Ground Microscope.

### **History**

**Types of Microscope:** (a) Light Microscope, (b) DGI, (c) Fluorescent, (d) Phase contrast.

**(e) Electron Microscope :** a). Transmission, b) Scanning, Principles of operational mechanisms of various types of Microscopes.

## III. Sterilization and disinfection – classification and Methods of sterilization.

### **Sterilization: Definition, types and principles of sterilization methods:**

(a) Heat (dry heat, moist heat with special reference to autoclave, (b) Radiation, (c) Filtration, efficiency testing to various sterilizers.

### **Antiseptics and Disinfectants :**

Definition, types and properties, mode of action, uses of various disinfectants, precautions while using the disinfectants, qualities of a good disinfectants, testing efficiency of various disinfectants.



- 1) Principle and Methods of sterilization by heat
  - a) By Dry Heat, flaming, Red Heat, Hot air oven, incineration.
  - b) By Moist Heat-pasteurization, Inspissation, tyndalisation, autoclave.

- 2) Filtration Methods

- 3) Ionising Radiation – Disinfection, Mode of action and uses of important chemical disinfectants – Phenol and Phenolic compounds, alcohols, halogens, dyes and acids and alkalis.

- 4) Gaseous Methods of sterilization.

- IV. Cleaning, drying & Sterilization of Glassware disposal of contaminated material i.e. clinical infective material inoculated culture media. Handling and Disposal of Biomedical waste.
- V. **Biomedical waste management in a Microbiology Laboratory** : types of the waste generated, segregation, treatment, disposal.
- VI. Morphology and classification of Bacteria Sp. of cell, capsule, flagella, spore, Anaerobic Methods of cultivation of Bacteria.

# Paper-III

## **A. Hospital Awareness**

A brief idea of hospital as an organization management different units of a hospital effective communication skills, communication channel

Maintenance of records  
Effective leadership  
General patient care  
Medical terminologies  
Vital signs  
Unit preparation  
Transporting & Transferring patients  
Sterilization Techniques  
Control of infection  
Medication – Oral & parenteral  
Admission – Discharge procedure  
Bandages

Practicals : Posted in ward & taught clinically

## **A. Surgical Department**

Familiarization of different tubes

1. Drainage tube
2. Post Operative Exercises
3. Post OP Management of Patient
4. Shock of Management
5. Changing Surgical Dressing.

1. Preoperative preparation of patient
2. Preanesthetic preparation
3. Assisting in operation
4. Anaesthesia
5. CSSD
  1. Recovery room
  2. Movement of papers
  3. Scheduling of theaters
  4. Supplying of articles
  5. Specific area practices
    - a. As scrubnurse
    - b. As circulating nurse

## **D).Communication and Computer Skills, Audio & Visual Aids.**

### **COMMUNICATION**

Process  
Types of communication  
Strategies for effective Communication  
Barriers of communication

### **SOFT SKILLS**

Presentation with the use of visual aids such as power point  
Conversation  
Extempore speech, usage of effective language for communication of health work.  
Case studies and situational analysis  
Survey and Reporting

### **COMPUTER**

Computer basic  
MS – Office  
MS – Word  
MS – Excel  
MS – Power Point

### **INTERNET CONCEPTS**

Browsing  
Down- Loading  
Use of Slide Projector

## Paper – III

### Dark Room Procedures

#### Dark room Techniques

1. Darkroom Construction.
2. List of darkroom accessories.
3. Radiographic film.
4. Handling of X-Ray films, types of films.
5. Processing of X-Ray films.
6. Methods of processing.
7. Mixing of processing solutions.
8. Chemistry of processing solutions.
9. Maintenance of processing solutions.
10. Safe light.
11. The radiographic image.
12. Film Density.
13. Film contrast.
14. The characteristic curve.
15. Control of radiographic image definition.
16. Latitude of exposure.
17. Variation in exposure time.
18. Intensifying screens / fluorescent screens.
19. Cassettes.
20. Faults in Radiography
21. CR. Computer Radiography
22. DR. Digital Radiography
23. Pass box.

## **RADIOLOGICAL PHYSICS AND RADIOLOGICAL EQUIPMENTS**

### **RADIOLOGICAL PHYSICS:**

1. Fundamentals of electricity
2. Static / Current electricity
3. Conductors & Insulators
4. The current
5. Electrical potential difference
6. Resistance
7. Units of measurements; Volt, ohm, ampere
8. Resistances in electrical circuits.
9. Resistors.
10. Specific resistance.
11. Power measurements.
12. Magnetism
13. Magnetic induction
14. Generator and dynamo
15. Alternating current generator
16. Direct current generator
17. Motor
18. Induction coil
19. Transformer
20. Auto transformer
21. Rectification
22. Capacitors & Conductors
23. Electrical circuits
24. Principles of electrical circuits
25. Constant potential circuits.
26. Electrical measuring instruments
27. X-rays
28. Florescent screens
29. Electrical measuring instruments
30. Characteristic radiation
31. Inverse square law
32. Interaction of X-rays on matter
33. Absorption coefficient
34. Half value layer
35. Filter & filtrations
36. Measurements of X-rays
37. GM counters
38. Ionization chamber measurements
39. Measuring devise in use presently
40. Radioactivity

**X-rays – Generation, Properties and Interaction:**

Electromagnetic,

Spectrum and general properties: Wave and quanta concept,

Processes of x- ray generation: General and characteristic radiation,

X-ray spectrum,

Factors influencing the intensity of x-rays.

Basic interactions diagnostic x-rays and matter: Coherent scattering photo electric effect and Compton Effect – Probability of occurrence and its applications in radiology.

Biological effects of radiation. Attenuation: Linear and mass attenuation coefficients, Half Value Layer, Factors affecting attenuation, practical aspects of these phenomenon in Radiology, scatter radiation.

**Radiation Protection & Measurements:**

Radiation quantities and units, Radiation measuring instruments : Gas filled detectors : ionization chamber, proportional counter, Geiger-Muller counter, scintillation counter, solid state detector, Personal monitoring devices: Film, Thermo luminescent and Pocket dosimeters.

Aim of radiation protection, concept of As Low As Reasonably Achievable, International Commission on Radiation Protection (ICRP) and Atomic Energy Regulatory Board (AERB) recommendations, maximum permissible dose, Principles of protection in X-ray department for patient, personnel and public, Time-Distance-Shielding, protective devices, X-ray room design.

**Radiographic Photography:**

X-ray films, Screen – film cassette, Characteristic curve, Radiographic Image Quality, Automatic Film Processor, Laser Camera: Wet and Dry, Computed Radiography & Digital Radiography.

**Electric Power & Transformers:**

Generation and distribution of electric power, Single and Polyphase supply, Fuses, Earthing.

Construction, types, working principle and losses of transformers.

Auto transformer: Construction, Working principle and Applications.

**X-Ray equipment & units:**

Construction of diagnostic X-ray tube: Stationary and rotating anode type, Line- Focus principle, Heel effect, X-ray tube rating, Grid controlled and Metal – Ceramic X-ray tubes.

Mammography, Mobile X-ray unit, Dental x-ray unit, Dual Energy X-ray Absorptiometry.

**X-ray generators:**

Filament and High Voltage circuits, Single phase generators. Self, Half wave and Full wave rectified, Three phase generators: 6 pulse-rectifier, 6 pulse-12 rectifier, 12 pulse-12 rectifier circuits, Power Storage Generators, High Frequency Generators, Falling Load Generators, Exposure Switches and Timers.

**Accessories in Fluoroscopy:**

X-ray beam restrictors, filters: Inherent, added, k-edge filters. Grids: Types, grid-ratio grid cut-off, moving grid. Air gap technique.

Basic principle, construction and working principle of image intensifier tube. Image characteristics, Image display and recording devices.

**Modified x ray Equipments for Special Purpose**

1. Portable & Mobile x ray equipment for OT & and bed side radiography
2. Special skull radiography unit
3. Tomographic equipment
4. Mammography equipment
5. Mass miniature radiography (MMR) unit
6. Dental radiography unit
7. Orthopantomography dental unit (OPG)
8. X ray image intensifier / radiography unit
9. C-ARM Image intensifier / radiography unit
10. Cline fluoroscopic – radiography unit & video recorder
11. AOT rapid film changer for serial radiography
12. Digital radiography unit.

## **Fundamentals of X-ray Equipments**

1. X-Ray equipments and power mains
2. Control of Kilo-voltage
3. Main voltage compensator
4. Components & Controls in X-ray circuit
5. HT generators
6. HT generator circuit
7. Constant potential circuits
8. Filament circuits
9. Fuses
10. Switches & circuit breakers
11. Inter locking circuits
12. Exposure switches & timers
13. Timer systems
14. Timer x ray tube
15. Fixed anode x ray tube
16. Rotating anode – dual focus x ray tube
17. X Ray tube glass envelop & vaccum
18. Tube shield
19. Shock proofing
20. H.T. Cables
21. Cooling mechanism
22. Filtration in x ray tube
23. Limitation of fixed abode x ray tube
24. Rotary anode x ray tube mechanism
25. Faults in x ray beam
26. New Developments in x ray tube
27. Details of x ray beam
28. Anode heel effect
29. Filtered radiation
30. Scattered radiation
31. Control of secondary radiation
32. Grids
33. Tube stand, ceiling – tube support
34. Tube stand parts
35. Tube breaks
36. Tube suspension and counter - weight
37. Ceiling tube hanging
38. Tube movements & their controls
39. Multipurpose tables for radiography / fluoroscopy



40. General features of radiographic tables
41. Table – drive and table movements
42. Fluoroscopic screen holder on assembly
43. Serial sport – film device
44. Structure of fluoroscopic screen
45. Remote controls on fluoroscopic assembly
46. Procedure for fluoroscopic radiography
47. Indications for fluoroscopy examination
48. The Bucky assembly
49. The Bucky circuitry
50. Reciprocating & oscillating grids

### **Practicals:**

- a) X-ray beam alignment test
- b) Determination of magnification by changing Source to Image Distance
- c) Determination of magnification by changing Object to Image Distance
- d) Radiation Protection Survey
- e) Leakage radiation test

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<b>Paper-II</b>	<ul style="list-style-type: none"><li>A) Radiographic Techniques &amp; Radiographic Anatomy, Radiological Physics &amp; Equipment.</li><li>B) Positioning Radiography &amp; Contrast Procedure</li><li>C) First Aid , Basic Nursing, Handling of Patients</li><li>D) Magnetic Resonance Imaging</li></ul>
<b>Paper-III</b>	<ul style="list-style-type: none"><li>A) Ultra Sound Imaging, Interventional Procedures &amp; Angiography</li><li>B) Basic &amp; Advanced CT Imaging</li><li>C) Basic &amp; Advanced MRI Imaging</li><li>D) Communication &amp; Computer Skills, Audio and Visual Aids</li></ul>

## **PAPER - I**

### **Radiation Hazards and Protections**

1. During radiography
2. During fluoroscopy
3. Effects of radiation on human tissues
4. Permissible doses
5. Measurement of radiation doses
6. Dosages in diagnostic radiology
7. Protective gadgets in RD Department
8. Radiation safety duties of radiologist, radiographer & patient.

### **Radiation Preventive Maintenance**

1. General care
2. Maintenance of log book
3. Practical precautions
4. Brakes & locks
5. HT cables care
6. Care of meters & controls
7. Care of tube stands & tracks
8. Care of accessory equipment
9. Functional tests for any faults
10. Failure of x ray tubes
11. Failure of HT cables
12. Common trouble – shooting & remedies

### **Regional Radiography**

#### **General**

Head & neck  
Spine  
Chest  
Abdomen  
Pelvis  
Upper limbs  
Lower limbs

#### **Special**

Macro – radiography  
Xero – radiography  
Mammography  
Dental radiography  
Orthopantomogram  
High K V technique  
Subtraction techniques

## **Special Diagnostic Procedures**

GUT-IVP,RAP, RAU, MEUG, Cystography, AGP, HSG.

GIT – Sialography, Barium swallow, BM Study, BMFT, SB enema, Ba enema, SPVG.

Biliary system – pTC, T tube cholangiogram, OCG.

Respiration – Bronchography

Vascular – Angiography of limbs, aorta, carotid vessels.

Contrast media – Type, reaction, treatment.

## PAPER - II

### Positioning Radiography and Contrast Procedures

#### **General:**

Age subject types and sex, anatomical landmarks-postural variations-erect and horizontal technique-respiratory movement and diaphragm level-regional densities-preparations-and immobilization of patient-pathological conditions-injuries, fractures and dislocations congenital, localized views-periodic examination-use of dry bones-positioning terminology identification systems.

#### **Positioning Radiography – I**

##### **Skeletal System**

##### **Upper Limb:**

Techniques for hand-fingers-thumb-wrist joint-forearm-elbow joint-humerus-shoulder joint and sterno- clavicular joint.

##### **Lower Limb:**

Techniques for foot-calcaneum-ankle joint-leg-knee joint-patella-and femur (lower two thirds)

##### **Pelvic Girdle:**

Techniques for pelvic-iliac fossa-ischium-and sacro iliac joint.

##### **Vertebral Colum:**

Techniques for Atlanto-occipital articulation, cervical vertebrae, cervico-thoracic junction, thoracic vertebrae, lumbar vertebrae, lumbosacral articulation, sacrum,

##### **Bones of Thorax:**

Techniques for sternum, ribs (upper and lower).

##### **Skull:**

Techniques for cranium, facial bones, sella turcica, temporal Bone and optic foraminae, sinuses, mandible and temporo mandible joint.

## **Positioning Radiography – II**

### **Abdomen:**

Routine and radiographs on acute condition

Bedside radiography – techniques for acute chest conditions-intestinal obstruction, abdominal perforations-vertebral injuries-skull injuries-fractures immobilized.

Theatre radiography-introduction to C-arm image intensifier-exposure & training.

### **Contrast Procedures –I**

Barium swallow-Barium meal series-Barium enema-double contrast barium enema, small bowel enema, double and single contrast, ERCP,PTBD, sonograms, fistulograms, mammograms.

### **Contrast Procedures – II**

IVU, retrograde pyelogram, MCU,AUG, Opposing Urethrogram, Dacrography, Sialogram, HSG,T-Tube cholangiogram, operative cholangiogram (on table in theatre).

## **Radiographic Technique and Radiographic Anatomy**

**Contrast media:** Barium preparation, Iodine preparation, Air-Oxygen.

**Skeletal system:** Upper limb, lower limb, shoulder, girdle and thorax, vertebral column, pelvic girdle and hip region. Teeth jaw.

**Accessory nasal sinuses:** Lachrymal system

**Cardiovascular system:** Upper respiratory passage, lungs, pleura, diaphragmatic excursion, Mediastinum, bronchography, artificial pneumothorax.

**Genioto-urinary system:** Straight X-ray of abdomen, pyelography, cystography, urethrography, gas insufflation, pneumo-peritonium.

**Obstetrics and Gynaecology:** Radiation protection, pregnancy, pelvimetry, hystero salpingography, placentography.

**Central nervous system:** Routine and special projections of skull, ventriculography and encephalography, cerebral angiography, myelograph.

**Alimentary system:** Barium suspension, Barium-meal and follow through Barium enema.

**Liver and spleen:** Spleno-portal venography.

**Silvery glands:** Sialography.

Arthrography, sialography, Lymhpangiography, Operation theatre technique and ward radiography.

Stereoscopy, Magnification, High and Low K.V. technique and Mammography.

## **First Aid, Basic Nursing, Handling of Patients**

Shock, convulsion, asphyxia, artificial respiration, Administration of Oxygen, Burns and scalds. Electric shock and burns. Wound, haemorrhage, pressure points, Tourniquet, Injuries to Bones, Joints and muscles, Dressing of Bandages, Plaster of Paris technique, Splints, Drug reaction, Poisons, Basic Nursing.

**Drug in Department:** Storage labeling. Checking, Regulation regarding dangerous drugs, Units of measurement.

**Medical Ethics:** Ethical law and professional etiquette s applied to members of profession associated with medicine.

**Nursing and Handling of patients:** Hospital and Departmental procedure, Hospital staffing and organization. Records and departmental statistics. Medico-legal aspects. Appoints. Stock taking and stock keeping.

**Care of patients:** Reception, Elementary hygiene.

**Nursing Care:** Temperature, pulses and respiration. Application of sterile dressings.

**Preparation of patients for General X-ray examination:** Departmental instructions to out-patients or ward-staff. Instructions for various special investigations. Nursing care before and after special X-ray. Drug allergy.

**Principles of asepsis:** Methods of sterilization. Care and identification of instruments. Setting of trays and trolleys. Elementary operating theatre procedure.

### **Tomography -**

#### **History:**

Basic principle and data acquisition/C.T. generations, Gantry and patient table - Travel Speed, Load capacity, X-ray tubes.

Rotating anode; cooling system; Collimeter; Pencil beam; Fan beam Anode heat storage capacity; Detector system: Type, number, Efficiency  
Generator, UPS & Voltage Stabilizer. Rectifier.

## **Magnetic Resonance Imaging**

### **History:**

Basic Physics

Magnets - Types, Powers, Magnetism; Nuclear Spin, Proton density;

Larmor equation; Radio Frequency (RF) Pulse;

T1 (Longitudinal relaxation time)

T2 [Transverse relaxation time]

Free induction decay

TR [time to repeat] and TE [time to echo] Flip Angle

Imaging process

Fourier transformation, Pixel, Matrix, Gantry and different types of coils,

Magnets and field gradients RF pulse and pulse sequences

Partial saturation & saturation recovery sequences

Inversion reversion sequence, Spine-echo sequence

Fast imaging sequence

Selection of slices; Slice thickness; Image storage; Contrast agents,

MR angiography & Dynamic MR Spectroscopy; Hazards and safety.

## **PAPER – III**

### **BASIC AND ADVANCED ULTRASOUND IMAGING**

#### **Ultrasound – Generation, Properties and Interaction:**

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.

Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, Construction and Working, Characteristics of US beam.

#### **Image Formation, Display and Quality:**

Ultrasound display modes: A,B,M, T-M mode, B-scan, Scan-converters: Analog and Digital, Image Quality: Axial, Lateral and Elevational resolutions, US Machine Controls, US Focusing.

Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducer : mechanical and electronic arrays, Ultrasound Artifacts.

#### **Techniques:**

Techniques for imaging different anatomic areas, Patient preparation for Doppler, Vascular sonography, Quantitative ultrasound densitometry.

#### **Doppler Ultrasonography:**

Doppler Effect, Doppler ultrasound techniques: Continuous Wave Doppler, pulsed Doppler, Duplex scanning, Doppler spectrum, Color Doppler, Power Doppler.

Harmonic imaging

Extended FOV imaging

3D US imaging: acquisition methods & reconstruction

4D & 5D US imaging.



## **INTERVENTIONAL PROCEDURES AND ANGIOGRAPHY**

### **Principle & Instrumentation:**

Digital Subtraction Angiography: Instrumentation, Principle of Digital Subtraction Angiography, Various Digital Subtraction Techniques.

### **Basics of Invasive Radiology:**

Procedure of image guided biopsies and drainage procedure.

### **Invasive Angiography & Venography:**

4 Vessel DSA

Aortogram

Selective Angiogram

Venogram

### **Invasive Monitoring:**

NIBP, Pulseoximetry, Cardiac resuscitation measures, IBP, ECG, Management of Shock.

### **Interventional Procedures:**

PTBD, Stenting, PTA + stenting, stent graft, Embolisation TIPS, drainage procedure.

### **Neuro Interventional Procedures:**

Embolisation,

GDC

Glue embolisation

Vertebroplasty

Direct puncture

### **Adult & Pediatric Invasive Cardiology:**

Basics of cardiac catheterization

Invasive monitoring

Coronary angiogram

## **BASIC AND ADVANCED CT IMAGING**

### **CT Imaging – Principle:**

Basic principle of Computed Tomography, Comparison of CT with Conventional Radiography and Tomography, Generations of CT.

### **Instrumentation:**

Gantry, Patient couch, X-ray tube, Filters, Collimators, Detectors, Data Acquisition System (DAS).

### **Image Formation:**

Image Formation in CT, CT Image Reconstruction, Hounsfield Unit, Windowing, CT image display, CT Image Quality, CT artifacts.

### **Advances in Ct Imaging:**

Helical CT scan : Slip ring technology, Advantages, Multi Detector CT, Cone-Beam geometry, Reconstruction of helical CT images, CT Fluoroscopy, HRCT, Post Processing Techniques : MPR, MIP, Min IP, 3<sup>D</sup> rendering : SSD and VR, Ct Dose.

### **Patient Preparation & Protocols:**

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: Filling, Maintenance.

## **BASIC AND ADVANCED MRI (MAGNETIC RESONANCE IMAGING)**

### **MRI Imaging- Principle:**

Basic Principle and concepts of MRI, the need for MRI, Role of hydrogen in MR Imaging, Advantages and disadvantages of MRI,

### **Instrumentation:**

MR architecture, magnet system and gradient system, patient screening before scanning, Safety aspects, types of magnets and RF coils,

### **Protocols:**

Different types of pulse sequence, Protocols in MRI for whole Body.

### **Image Formation:**

Fourier transformation, K space imaging, Image formation in MRI, Gating mechanism in MRI,

### **Advanced MRI Techniques:**

MR Angiography, (TOF, phase contrast and dynamic contrast MR angiography), Functional MRI, MR Spectroscopy, Recent advancement in MRI and open MRI.

### **Practicals:**

- a) Basic ultrasound techniques.
- b) Practical based on theory.
- c) Invasive monitoring
- d) Interventional procedures technique
- e) Positioning Radiography
- f) Contrast Procedures.