ANDHRA PRADESH PARA MEDICAL BOARD
HYDERABAD
(Established Under the Andhra Pradesh Para Medical Board Act, 2006)
(A.P. Act No. 38 of 2006)

******

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 1st year in all Para medical courses is modified accordingly the modified Syllabus for 1st year is kept on website.

<table>
<thead>
<tr>
<th>Basic Human Sciences</th>
<th>Physical Sciences</th>
<th>Paper-I</th>
<th>Paper-II</th>
<th>Paper-III</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Basics of Anatomy</td>
<td>A) Basics of Pathology</td>
<td>B) Basics of Physiology</td>
<td>B) Basics of Blood Banking</td>
<td></td>
</tr>
<tr>
<td>B) Basics of Physiology</td>
<td>C) Basics of Microbiology</td>
<td>C) Basics of Bio-chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D) Basics of Bio-statistics</td>
<td></td>
<td></td>
<td></td>
<td>A) Hospital awareness,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B) Familiarization of different tables/tubes in surgical dept. Surgical</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Awareness, Preparation of patient for surgery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C) Patient related services.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D) Communication &amp; Computer Skills,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Audio and Visual Aids</td>
</tr>
</tbody>
</table>
### Syllabus for Second Year

| Paper-I | A) Radiation Hazards, Protection Preventive Measures.  
|         | B) Dark Room Procedure,  
|         | D) Special Diagnostic Procedures |
|         | 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  
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 Subsatance

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.


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.
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, Epithelial 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.
I. Introduction to Microbiology in brief
   Definition, History

II. Microscopy

   a) Principle working and maintenance of compound Microscope.

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


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 Merit Heat-pasteurization, Inspissation, tyndalisation, autoclave.

2) Filtration Methods

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

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.
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.
7. Mixing of processing solutions.
8. Chemistry 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 / flouroscent screens.
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.
10. Specific resistance.
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:

Electric Power & Transformers:
Generation and distribution of electric power, Single and Polyphase supply, Fuses, Earthing.
Construction, types, working principle and losses of transformers.

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:**

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
| Paper-I | A) Radiation Hazards, Protection Preventive Measures.  
B) Dark Room Procedure,  
D) Special Diagnostic Procedures |
| --- | --- |
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) Communication & Computer Skills, Audio and Visual Aids |
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

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.

Billiary system – pTC, T tube cholangiogram, OCG.

Respiration – Bronchography

Vascular – Angiography of limbs, aorta, carotid vessels.

Contrast media – Type, reaction, treatment.
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:

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 cute 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


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.

Genito-urinary system: Straight X-ray of abdomen, pyelography, cystography,
urethography, 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
emena.

Liver and spleen: Spleno-portal venography.

Silvery glands: Sialography.
Arthrography, singraphy, Lynmphangiography, 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 9time to repeat] and TE [time to echo] Flip Angle Imaging process Fourier transformation, Pixel, Matrix, Gantry and different types of coils, Magnetsandfield 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.


Image Formation, Display and Quality:


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:


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 mage 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, 3D 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) Practicals based on theory.
c) Invasive monitoring
d) Interventional procedures technique
e) Positioning Radiography
f) Contrast Procedures.