



College of Physicians and Surgeons of Mumbai

Syllabus for CPS-PG-Course

DMRE -DIPLOMA IN MEDICAL RADIOLOGY AND ELECTROLOGY

College of Physicians and Surgeons of Mumbai

CPS House, Dr. E. Borges Marg, Parel, Mumbai – 400012.

DMRE-DIPLOMA IN MEDICAL RADIOLOGY AND ELECTROLOGY

COURSE DESCRIPTION

Eligibility: A candidate should possess MBBS degree/ equivalent degree as per provisions of Indian Medical Council Act.

Duration: 2 Years

Log Book : A log book has to be maintained by all students in which a written record of all the procedures done, cases seen, interesting cases discussed is kept. This log book has to be regularly counter checked by the teacher. The log book has to be submitted to the college whenever asked for and has to be brought by the candidate for the practical examination.

At the end of the course, students should have acquired knowledge and skills in following

- A. Cognitive domain
 - 1. Should be conversant with various imaging technologies such as X-ray, mammography, USG, Doppler, CT scan, MRI etc. He should also be conversant with safety issues, diagnostic features and limitation these modalities.
 - 2. Acquire basic knowledge in the radiology of various systems.
 - 3. Independently conduct and interpret routine and special imaging investigations.
 - 4. Should have adequate knowledge to conduct various image-guided interventional procedures for diagnosis and management.
 - 5. Should adequate knowledge to diagnose any condition using appropriate radiological investigation.
 - 6. Should adequate knowledge to guide the clinician in deciding the correct treatment plan.
 - 7. Should have adequate knowledge about various acts and regulations such as PCPNDT etc
 - 8. Should have adequate knowledge to select the appropriate investigation.
 - 9. Should be able to select correct kVP, mA and other factors for the requisite X-ray.
 - 10. Should have adequate knowledge about radiological safety.

B. Affective Domain:

1. Should develop communication skills to interact effectively with patients, relatives and colleagues and other hospital staff.
2. Should always adopt ethical principles and practices
3. Should be able to work a member of a team for effective care delivery system
4. Should develop an attitude to contribute effectively in the improvement, maintenance of health care delivery system of the country and to contribute in improving the health indicators of our country in comparison with the other developed world.

C. Psychomotor domain

Practical training will include two major aspects:

- A) Interpretation of images, and
- B) Skill in performing a procedure.

A) Interpretation of images:

The student should be able to interpret images on all imaging modalities of diseases of following organs :

1. **Respiratory System** – Interpretation of diseases of the chest wall, diaphragm, pleura and airway; pulmonary infections, pulmonary vasculature; pulmonary neoplasm; diffuse lung disease; mediastinal disease, chest trauma; post-operative lung and X-ray in intensive care.
2. **Cardiovascular System** - Interpretation of diseases and disorders of cardiovascular system (congenital and acquired conditions) and the role of imaging by conventional radiology, ultrasound, colour Doppler, CT, MRI, Angiography and isotope studies.
3. **Gastro-intestinal tract and hepato-biliary pancreatic system** - Interpretation of diseases and disorders of mouth, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, diseases of omentum, peritoneum and mesentery: acute abdomen, abdominal trauma, diseases and disorders of liver, biliary system and pancreas.
4. **Urogenital System** - Interpretation of various diseases and disorders of genitourinary system. These include: congenital, inflammatory, traumatic, neoplastic, calculus disease and miscellaneous conditions.
5. **Central Nervous System (C.N.S.)** - Interpretation of diseases and disorders of the head, neck and spine covering, congenital, infective, vascular, traumatic neoplastic degeneration metabolic and miscellaneous condition.

6. **Musculo-skeletal System** - Interpretation of diseases of muscles, soft tissue, bones and joints including congenital, inflammatory, traumatic, endocrine and metabolic, neoplastic and miscellaneous conditions.
7. **Imaging in Emergency Medicine.**
8. **Imaging in Obstetrics and Gynecology.**
9. **Imaging of Breast and interventional procedures.**
10. **Imaging of endocrine glands and those involved with metabolic diseases.**
11. **Clinical applied radionuclide imaging.**
12. **Interventional radiology.**

B. The student should be able to perform the following procedures:

- 1) **GIT contrast studies** : Barium studies (swallow, upper GI, Follow through, enema); fistulogram; sialogram; cologram/ileostogram
- 2) **GU: IVP**, Excretory urography, MCU, RGU, nephrostogram, genitogram
- 3) **Ultrasound**: Studies of whole body including neonatal transfontanell studies, Doppler studies, TVS
- 4) **CT scan**: should be able to position a patient, plan study as per the clinical indication, do reconstruction of images, perform triple phase study. Should be able to work on console for image construction and reconstruction.
- 5) **MRI**: plan and perform MRI studies of whole body.
- 6) **DSA**: should be able to describe the techniques,
- 7) **Radiography**: should be able to independently do radiography of common and some important uncommon views of different body parts. This includes positioning, centering of X ray beam, setting of exposure parameters, exposing and developing the films. He / She should be familiar with not only conventional radiography but with CR and DR systems.
- 8) **Interventional radiology**: The student should be able to perform simple, common non-vascular procedures under ultrasound and fluoroscopy guidance e.g. abscess drainage, drainage catheter placement, nephrostomy, biliary drainage etc.

Syllabus

DMRE (Part-I)

Part 1: Paper – I – Section – I

PHYSICS - RELEVANT TO RADIOLOGY

A. X-rays

- a. Introduction to Electromagnetic spectrum.
- b. Discovery, Nature, Source of X-Rays
- c. The X-ray tube
- d. Conditions necessary for production of X-rays
- e. Electron interaction with target atoms x-ray production
- f. Target materials
- g. Efficiency of x-ray production
- h. Concepts of kVP, mA and ms
- i. Physical characteristics of x-ray beam
- j. Hard and soft x-rays
- k. The interaction of ionization radiation with matter.
- l. Various types of interactions in radiology
- m. Modification of x-ray beam with filters.

B. X-ray Tubes and rectifiers.

- a. Radiographic tubes
- b. X-Ray therapy tubes
- c. Rectifiers and failure of rectifier – spin top test

C. X-Ray Circuits

- a. Main x-ray circuits
- b. Battery powered mobile x-ray units
- c. Capacitor discharge mobile x-ray units

D. X-Ray Films

- a. Composition of X-ray films
- b. Types of films
- c. Film exposure holder
- d. Intensifying screens

E. The Dark Room:

Location, size, ventilation ,lighting, apparatus and equipments.

F. X-Ray Film Processing

- a. Radiographic photography
- b. Radiographic chemistry
- c. Manual processing
- d. Automated processing

G. Radiographic Quality

- a. Factors governing blur
- b. Focal spot evaluation – pin hole camera test
- c. Motion blur
- d. Screen blur
- e. Density, contrast and distortion

H. Devices for improving radiographic quality

- a. Scattered radiation
- b. Removal of scattered radiation by grids
- c. Stationary and moving grids
- d. Removal of scattered radiation by air gap
- e. Other methods of enhancing radiographic quality

I. Radioactivity and Radium

- a. Radioactivity, radium, radioactive decay, radon, radio-active equilibrium.

J. Artificial Radioactivity

- a. Isotopes
- b. Artificial radio nuclides
- c. Applications of Radio nuclides in Medicine
- d. Radionuclide counting- GM Counter

References:

1. "The fundamentals of X-ray and Radium Physics" by Joseph Selman. Ch.12-21
2. Farris : Physics for medical imaging by Penelope Allisy – Robert JerryWillims

Part 1 : Paper – I – Section – II

A. Contrast Media

- a. Ionic & non-ionic contrast
- b. Indications for contrast
- c. Contra-indications
- d. Drug reactions
- e. Treatment of contrast reaction

B. Medico legal aspects of radiology

- a. PCPNDT Act

b. Consumer Protection Laws and Consumer Rights

C. Radiation protection

- a. Radiation Protection Methods
- b. Patient Radiation Protection
- c. TLD Badge
- d. Radiation Protection Method for Radiology Equipment

D. Computers in Radiology

- a. Different parts of computers and their working
- b. Data storage devices in computers
- c. PACS – Picture archiving and communication systems
- d. Tele-Radiology
- e. Internet in Radiology

E. Radio-Anatomy

- a. Brain
- b. CNS Vasculature
- c. Shoulder, Knee, Wrist Joint, Hip-joint.
- d. Broncho-pulmonary segments of Lung
- e. Liver Segments
- f. Kidneys
- g. Aorta
- h. Temporal Bone – Middle and Inner Ear
- i. Retroperitoneum

Part 1 :Paper – 2 – Section I

Instrumentation – Principles & Equipment; Layout, Working & Diagram.

- a. Physics of Ultrasound
- b. Various parts of ultrasonography machine and their working
- c. A B Scan and M mode. Continuous and pulsed Doppler and colour Doppler
- d. Recent advances in different imaging modalities
- e. Various types of cameras used in printing MRI and CT films
- f. X-Ray, Digital Radiology and CR
- g. Digital Radiography, CR X-ray systems and DR x-ray systems
- h. Difference between analog and digital data
- i. Dark Room
- j. Mammography
- k. Mammography principles and technique. Equipment /tube
- l. MRI: Physics, indications and procedures of MRI, MR angiography
- m. Spin echo FSE, Gradient and inversion recovery, diffusion sequences
- n. MR angiography
- o. CT: Physics, indications and procedure of CT Scan, SPECT, PET
- p. Evolution of CT scans, historical aspects
- q. CT tubes, other parts of CT machine
- r. PACS

Part 1 : Paper – 2 – Section II

A. Radiographic Procedures

- a. IVP, Barium studies, urethrography, hysterosalpingography
- b. CT and USG guided aspiration of pleural effusion, abscess, collection
- c. CT or USG guided biopsy
- d. Renal biopsy
- e. Prostate biopsy
- f. Biopsy of Chest and Abdominal lesions

B. X-Ray Positioning

Positioning of all radiographs

C. Special views Protocols

- a. Ultrasound methods and protocols
- b. CT Protocols
- c. MRI Protocols

DMRE (Part-I)**EXAMINATION PATTERN****Theory Examination:**

PAPER I	PAPER II
PHYSICS AND ELECTRO-TECHNIQUES	IMAGING & MONITORING EQUIPMENT & RECENT ADVANCES.
Section I	Section I
Q.1. 10 Marks Q.2. 10 Marks Q.3. 10 Marks Q.4. 10 Marks Q.5. 10 Marks Total 50 Marks	Q.1. 10 Marks Q.2. 10 Marks Q.3. 10 Marks Q.4. 10 Marks Q.5. 10 Marks Total 50 Marks
Section II	Section II
Q.6. 10 Marks Q.7. 10 Marks Q.8. 10 Marks Q.9. 10 Marks Q.10. 10 Marks Total 50 Marks	Q.6. 10 Marks Q.7. 10 Marks Q.8. 10 Marks Q.9. 10 Marks Q.10. 10 Marks Total 50 Marks
Section I + II = 100	Section I + II = 100
Total Theory = 200 Marks, Passing = 100 (i.e. 50%) Marks aggregate	

Practical Examination:		Marks
Paper III	Instruments & modern methods of diagnosis	100
Paper IV	Imaging & monitoring of equipment & advances.	100
Total Marks	(Aggregate marks for passing is 50% out of total.)	200

Part II

1. Chest and respiratory system

- a. Gross, cross sectional and radiological anatomy of chest and respiratory system
- b. Normal chest: methods of investigation, various radiological signs and aptterns and their differential diagnosis
- c. Mediastinum: Anatomy, radiological investigations
- d. Anatomical location and differential diagnosis in mediastinal masses
- e. Role of X-ray, USG, CT, MRI and other radiological modalities in the diagnosis of mediastinal mass.
- f. Pleura and pleural cavity, pleural effusion, pneumothorax, pleural tumors and other diseases of pleura and pleural cavity.
- g. Role of X-ray, USG, CT, MRI and other radiological modalities in the diagnosis of diseases of pleura and pleural cavity.
- h. Pulmonary infections and role of various diagnostic modalities in the diagnosis of pulmonary infections.
- i. Tumors of lung and their radiological diagnosis and staging
- j. Collapse, Consolidation and other diseases of airways.
- k. Role of X-ray, USG, CT, MRI and other radiological modalities in the diagnosis of diseases of airways.
- l. Interstitial lung diseases and role of radiology in their diagnosis.
- m. Role of radiodiagnosis in chest trauma

- n. Radiology of chest in special circumstances like paediatric chest diseases, geriatric chest diseases
- 2. Cardiovascular system
 - a. Normal heart: Gross, cross sectional and radiological anatomy
 - b. Various imaging techniques for diagnosis in CV diseases
 - c. Valvular heart diseases and imaging in these conditions
 - d. Coronary heart disease and imaging modalities
 - e. Congenital heart diseases and imaging modalities
 - f. Role of radiology in pulmonary embolism
 - g. Arteriography, phlebography, lymphography and interventions
- 3. Abdomen and GI tract
 - a. Gross, cross sectional and radiological anatomy of abdomen, all organs of GI tract
 - b. Gross Pathology of GI tract
 - c. Role of X-ray, USG, CT, MRI and other modalities in imaging of diseases of salivary glands, oesophagus, pharynx and oral cavity
 - d. Diseases involving stomach, duodenum, small and large intestines, colons, rectum and anal canal. Role of various radiological modalities including special investigations in their diagnosis.
 - e. Diseases of liver, biliary tract, pancreas, spleen, adrenals and peritoneal cavity. Role of various radiological modalities including special investigations in their diagnosis.
 - f. Retroperitoneal lesions
 - g. Role of radiology in acute abdomen, abdominal trauma.
 - h. Congenital, neonatal and pediatric conditions involving GI tract. Role of radiology in their diagnosis.
- 4. Genitourinary system
 - a. Gross, cross sectional and radiological anatomy of urogenital tract
 - b. Embryology of urogenital tract.
 - c. Gross Pathology of urogenital tract.

- d. Role of X-ray, USG, CT, MRI and other modalities in imaging of diseases of kidneys and ureters.
- e. Diseases involving bladder, prostate, urethra. Role of various radiological modalities including special investigations in their diagnosis.
- f. Radiology in diseases of scrotum.

5. Skeletal system

- a. Gross and radiological anatomy of bones, joints and other organs
- b. Embryology of skeletal system
- c. Gross pathology involving skeletal system

Details of following conditions and role of various imaging techniques in the diagnosis of these conditions..

- d. Congenital skeletal anomalies, dysplasias and chromosomal abnormalities
- e. Infections of bones and joints.
- f. Diseases of joints.
- g. Tumors and tumor like conditions of bone.
- h. Metabolic and endocrine disorders affecting bones and joints
- i. Fractures of various bones .Imaging and diagnosis in fractures and other skeletal injuries.
- j. Imaging of soft tissues.

6. Breast imaging

7. Central Nervous system

- a. Gross, cross sectional and radiological anatomy of CNS
- b. Embryology of CNS
- c. Normal vascular anatomy
- d. Sinuses
- e. Gross pathology involving skeletal system
- f. Diseases of neck, sinuses, teeth and jaws, eye and orbit
- g. Diseases involving petrous temporal bone, skull
- h. Neuroradiology of spine

- i. Angiography in neuroradiology
Imaging in following conditions
 - j. Intracranial hemorrhage
 - k. Intracranial aneurysms and vascular malformations
 - l. Stroke
 - m. Intracranial lesions and tumors
 - n. Infections of the brain and meninges
 - o. Inherited metabolic, white matter and degenerative diseases of the brain
 - p. Acquired metabolic, white matter and degenerative diseases of the brain
 - q. Tumors and tumor like lesions of spine
 - r. Trauma
 - s. Recent advances
8. Obstetric and gynecological imaging
- a. Gross, cross sectional and radiological anatomy of Uterus, Ovary, fallopian tubes and other organs
 - b. Embryology and organogenesis
 - c. Radiological changes in menstrual cycle
 - d. Radiological diagnosis of pregnancy
 - e. First trimester USG for aneuploidy
 - f. USG evaluation of first trimester of pregnancy
 - g. USG evaluation of fetal biometry, normal and abnormal fetal growth
 - h. USG evaluation of normal fetal anatomy of different systems
 - i. USG evaluation of fetal neural axis
 - j. USG evaluation of fetal face and neck
 - k. USG evaluation of fetal thorax
 - l. USG evaluation of fetal heart
 - m. USG evaluation of fetal abdominal wall, GI tract and GU tract
 - n. USG evaluation of fetal abdominal wall
 - o. USG evaluation of fetal placenta and umbilical cord
 - p. USG evaluation of cervix
 - q. USG evaluation of amniotic fluid volume

- r. USG evaluation of multiple pregnancies
 - s. USG evaluation of trauma in pregnancy
 - t. Normal anatomy of female pelvis
 - u. USG evaluation of uterus and adnexa
 - v. Abnormal bleeding and imaging
 - w. Gestational trophoblastic neoplasia
 - x. Imaging in breast diseases
 - y. Imaging in ectopic pregnancy
 - z. Role of CT and MRI in gynecological diseases.
9. Recent advances
- a. Introduction to PET imaging
 - b. Virtual intraluminal endoscopy
 - c. H- MR spectroscopy and chemical shift imaging
 - d. Advances in contrast agents

TEACHING AND LEARNING METHODS

The training is spread over 2 years and includes following components:
atories in medical colleges is mandatory.

Rotations

During the two year course, the student will work in the following areas:

Conventional X-ray and mammography etc	6 months
Special investigations and contrast studies	3 months
USG, Doppler and US-guided interventions	6 months
CT and CT-guided interventions	4 months
M.R.I.	3 month
Emergency Radiology	1 month
Elective posting	1 month

Total 24 months

During each posting, post graduate student should be able to perform the procedures and interpret the findings

DMRE (Part-II)**EXAMINATION PATTERN****Theory Examination:**

Theory Examination: (* divisions are arbitrary and there may be overlap of systems in theory papers)

PAPER I	PAPER II	PAPER III
RADIOLOGICAL METHODS, Chest, CVS.	CNS, Musculo-skeletal, Breast	Abdominal Imaging including GI, GU, Hepatobiliary, endocrine and metabolic, Interventional radiology, Obstetrics and Gynaecology, and recent advances
Section I	Section I	Section I
Q.1. 10 Marks Q.2. 10 Marks Q.3. 10 Marks Q.4. 10 Marks Q.5. 10 Marks Total 50 Marks	Q.1. 10 Marks Q.2. 10 Marks Q.3. 10 Marks Q.4. 10 Marks Q.5. 10 Marks Total 50 Marks	Q.1. 10 Marks Q.2. 10 Marks Q.3. 10 Marks Q.4. 10 Marks Q.5. 10 Marks Total 50 Marks
Section II	Section II	Section II
Q.6. 10 Marks Q.7. 10 Marks Q.8. 10 Marks Q.9. 10 Marks Q.10. 10 Marks Total 50 Marks	Q.6. 10 Marks Q.7. 10 Marks Q.8. 10 Marks Q.9. 10 Marks Q.10. 10 Marks Total 50 Marks	Q.6. 10 Marks Q.7. 10 Marks Q.8. 10 Marks Q.9. 10 Marks Q.10. 10 Marks Total 50 Marks
Section I + II = 100	Section I + II = 100 Marks	Section I + II = 100 Marks
Total Theory = 300 Marks, Passing = 150 (i.e. 50%) Marks aggregate in Theory		

Practical Examination:		Marks
Paper - IV	Clinical Radiology and Radio Diagnosis	100
Paper - V	Diagnostic evaluations (2 Short Case)	100
Paper - VI	Appliances and Viva Voce Examination (25 Spotters – 50 marks + Table Viva – 50 Marks)	100
Total Marks	(Aggregate marks for passing is 50% out of total.)	300