

Guidelines
for
Competency Based Training
Programme
in
DNB- RADIO DIAGNOSIS



NATIONAL BOARD OF EXAMINATIONS

Medical Enclave, Ansari Nagar, New Delhi-110029, INDIA
Email: mail@natboard.edu.in Phone: 011 45593000

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PROGRAMME GOAL

- To make them understand & implement the knowledge regarding the role of various imaging modalities, helpful in the management of different clinical conditions. At the end of his/her training, he/she should be capable to take up a career in teaching institution or in diagnostic center or in research..
- Aimed at imparting training in both conventional radiology and modern imaging techniques so that the candidate is fully competent to practice, teach and do research in the broad discipline of radiology including ultrasound, Computed Tomography and Magnetic Resonance Imaging. Candidate should be well versed with medical ethics and consumer protection act and the Prenatal Diagnostic Technique (PNDT) Act.
- To orient and train student in different aspects of diagnosis with interventional radiology
- Special emphasis will be on new imaging techniques like (USG, CT, MRI) interventional radiology.
- Training will be oriented for technical aspects of clinical radiology and applied radiology and post treatment follow up in cancer.
- Ultimate goal will be to provide quality education for the post graduates and quality diagnostic care for different sections of the society

PROGRAMME OBJECTIVES

- Etiology, patho-physiology, and principles of diagnosis and management of common problems including emergencies, in adults and children.
- Demonstrate understanding of basic sciences relevant to this specialty.
- Identify important determinants in a case (e.g. social, economic, environmental and take them into account for planning therapeutic measures.
- Recognize conditions that may be outside the area of specialty/competence and to refer them to proper specialist or ask for help.

- Advise regarding the management (including interventional radiology) of the case and to carry out the management effectively.
- Update oneself by self-study and by attending courses, seminars, conferences and workshop which are relevant to the field of radio-Diagnosis.
- Carry out guided research with the aim of publishing his/her work and presenting work at various scientific fora.
- Take a proper clinical history, examine the patient, perform essential diagnostic/interventional procedures and interpret the results to come to a reasonable diagnosis or differential diagnosis in the condition.
- Provide basic life saving support service in emergency situations.
- Undertake complete patient monitoring including the care of the patient.
- Independently conduct and interpreted all routine and special radiological and imaging investigations
- Interact with other specialists for the maximum patient benefit
- Undertake further specialization in field of Radiology
- To conduct teaching program for undergraduate and paramedical and technical staff
- Adopt ethical principles in all aspects of his/her practice. Professional honesty and integrity to be fostered.
- Develop communication skills in order to explain the various options available in management and to obtain a true informed consent from the patient.
- Be humble and accept the limitations of his knowledge and skills and to ask for help from colleagues/ seniors when needed.
- Respect patient rights and privileges including patient's right to information and right to seek a second opinion.
- Organize CMES and workshops utilizing modern methods of teaching and evaluation

ELIGIBILITY CRITERIA FOR ADMISSIONS TO THE PROGRAMME

(A) DNB Radio Diagnosis Course:

1. Any medical graduate with **MBBS** qualification , who has qualified the **Entrance Examination** conducted by NBE and fulfill the eligibility criteria for admission to DNB **Broad Specialty** courses at various NBE accredited Medical Colleges/ institutions/Hospitals in India is eligible to participate in the Centralized counseling for allocation of DNB Radio Diagnosis seats purely on merit cum choice basis.
2. Admission to 3 years post MBBS DNB Radio Diagnosis course is only through **Entrance Examination** conducted by NBE and Centralized Merit Based Counseling conducted by National Board of Examination as per prescribed guidelines.

(B) DNB (Post diploma) Radio Diagnosis Course:

1. Any medical graduate with MBBS qualification who has successfully completed **DMRD** (and fulfill the eligibility criteria for admission to DNB (Post Diploma) Broad Specialty courses at various NBE accredited Medical Colleges/ institutions/Hospitals in India is eligible to participate in the Centralized counseling for allocation of DNB (Post Diploma) **Radio Diagnosis** seats purely on merit cum choice basis.
2. Admission to 2 years post diploma DNB **Radio Diagnosis** course is only through PDGET Centralized Merit Based Counseling conducted by National Board of Examination as per prescribed guidelines.

Duration of Course:

For Primary candidates : 3 years
For Secondary Candidates : 2 years

Every candidate admitted to the training programme shall pursue a regular course of study (on whole time basis) in the concerned recognized institution under the guidance of recognized post graduate teacher for assigned period of the course.

TEACHING AND TRAINING ACTIVITIES

The fundamental components of the teaching programme should include:

1. Case presentations & discussion- once a week
2. Seminar – Once a week
3. Journal club- Once a week
4. Grand round presentation (by rotation departments and subspecialties)- once a week
5. Faculty lecture teaching- once a month
6. Clinical Audit-Once a Month
7. A poster and have one oral presentation at least once during their training period in a recognized conference.

The rounds should include bedside sessions, file rounds & documentation of case history and examination, progress notes, round discussions, investigations and management plan) interesting and difficult case unit discussions.

The training program would focus on knowledge, skills and attitudes (behavior), all essential components of education. It is being divided into theoretical, clinical and practical in all aspects of the delivery of the rehabilitative care, including methodology of research and teaching.

Theoretical: The theoretical knowledge would be imparted to the candidates through discussions, journal clubs, symposia and seminars. The students are exposed to recent advances through discussions in journal clubs. These are considered necessary in view of an inadequate exposure to the subject in the undergraduate curriculum.

Symposia: Trainees would be required to present a minimum of 20 topics based on the curriculum in a period of three years to the combined class of teachers and students. A free discussion would be encouraged in these symposia. The topics of the symposia would be given to the trainees with the dates for presentation.

Clinical: The trainee would be attached to a faculty member to be able to pick up methods of history taking, examination, prescription writing and management in rehabilitation practice.

Bedside: The trainee would work up cases, learn management of cases by discussion with faculty of the department.

Journal Clubs: This would be a weekly academic exercise. A list of suggested Journals is given towards the end of this document. The candidate would summarize and discuss the scientific article critically. A faculty member will suggest the article and moderate the discussion, with participation by other faculty members and resident doctors. The contributions made by the article in furtherance of the scientific knowledge and limitations, if any, will be highlighted.

Research: The student would carry out the research project and write a thesis/ dissertation in accordance with NBE guidelines. He/ she would also be given exposure to partake in the research projects going on in the departments to learn their planning, methodology and execution so as to learn various aspects of research.

SYLLABUS

Physics related to Radio diagnosis

- Introduction to general properties of radiation and matter. Fundamental of nuclear physics and radioactivity.
- Production of x-ray
- X-ray generating apparatus
- Interaction of x-rays and gamma rays with matter and their effects on irradiated materials.
- Measurement of x and gamma rays
- Interaction of x-rays with the patients
- Radiographic image
- The image receptor
- Contrast media.
- Radiation protection & Radiation hazard
- Picture archiving and communication system (PACS) and Radiology Information system
- Image quality and quality assurance
- Radionuclide imaging (gamma camera, spect. PET)
- Computed tomography
- Principles of diagnostic ultrasound and Doppler
- Magnetic resonance imaging

Radiography and Processing techniques

- Dark room technique
- Radiography of the extremities
- Radiography of the spine, abdomen, pelvic girdle and thorax
- Radiography of the skull
- Contrast techniques of GI tract, biliary tract, GU tract
- Contrast techniques of C.N. system
- Contrast techniques of the cardio vascular system including chest
- Miniature radiography, macro radiography & magnification techniques
- Pediatric Radiography
- Dental , portable and emergency radiography
- Contrast & contrast reactions
- Quality Assurance

Anatomy

- Gross and cross sectional anatomy of all the body systems.

Pathology

- Gross morphology of pathologies condition of systemic disease.

RADIODIAGNOSIS –COURSE CONTENTS

Various diseases involving the following systems-

- Musculoskeletal System
- Respiratory System
- Cardio-vascular system
- Gastro-intestinal tract including Hepatobiliary system
- Urogenital tract.
- C.N.S. including spine
- Radiology of obstetric and Gynecology
- E.N.T, EYES, Teeth, soft tissue, Breast.
- Endocrinal Glands
- Clinical applied radionuclide imaging.
- PAC'S, digital radiography and other recent advances, molecular and Functional imaging.
- Emergency radiology and trauma
- Interventional Radiology related to different system of the body.
- Radiation Physics.

Contrast Agents:-

Contrast media, their type, formulation, mechanisms of action, dose schedule, routes of administration, adverse reactions and their management and recent development.

THE RESPIRATORY SYSTEM

- The normal chest, methods of investigations, techniques, interpreting chestradiograph and disease differential diagnosis. The mediastinum, chest wall, pleura and diaphragm; Diseases of airways: collapse and consolidation; pulmonary infections ; pulmonary neoplasm's;
- Diffuse lung diseases; occupational lung disease; chest trauma, pulmonary thromboembolism; chest in critical care patients, interventional techniques ; chest in neonates, and pediatric chest radiology.

THE CARDIOVASCULAR SYSTEM:

- Goal is to provide experience in the role of imaging in cardiovascular diseases by different techniques including cardiac catheterization and cardiac angiography, Digital subtraction angiography (DSA) and interventional procedures in non cardiac arterial and venous diseases
- Diseases and disorders of cardiovascular system including congenital conditions and the role of imaging by conventional, ultrasound, Echo, color-Doppler, CT, MRI, angiography (including DSA) and radionuclide studies. It also includes interventional procedures e.g; balloon angioplasty, embolization etc.
- Understand the anatomy and common pathology of congenital and acquired cardiac conditions.
- Correlate plain film findings of common congenital abnormalities with those shown by angiography and explain the pathophysiology including abnormal pressure measurements.
- Correlate plain film findings and the echocardiographic studies of patients with acquired valvular diseases and other common pathologic conditions including pericardial pathology.
- Understand the role of newer modalities like CT/MRI, in aortic diseases e.g., aorto- arteritis, aortic dissection and aortic aneurysm.
- Should be able to perform fluoroscopy on patients before and after valve replacement and identify those with complications after valve replacement.
- Understand the principle and logic behind various interventional procedures carried out in the cardiovascular labs e.g; PTCA, balloon dilatation of valvular lesions, septostomy etc.
- The normal heart: anatomy and techniques of examination.
- Acquired heart disease
- Techniques: the chest radiograph, non-invasive imaging echocardiography, nuclear imaging, CT, MRI. Invasive imaging and interventional techniques
- Congenital heart disease, ischemic heart disease, radiology of pulmonary circulation, cardiac myopathies and tumors, pericardial disease cardiac transplant surgery; role of Radiology in cardiac prostheses and

pacemakers, Arteriography and interventional angiographic techniques, Phlebography

THE ABDOMEN AND GASTROINTESTINAL TRACT

- Basic anatomy and physiology in clinical practice relevant to imaging examinations of the gastrointestinal tract, hepatobiliary tract, pancreas
- Clinical significance of pathology associated with clinical presentation and link with likely diagnoses
- Construction of appropriate imaging pathway and protocol considering different pathologies and management options and according to available resource and case complexities
- Common surgical procedures, expected post-operative imaging appearances and common complications
- Understand indications, contraindications and limitations of relevant specialized barium/contrast imaging examinations of the gastrointestinal and hepatobiliary tract
- Role of plain films in modern era imaging of GIT
- Conventional examination of GIT using barium and water soluble contrast media- esophagus, upper gastrointestinal study, follow through for small bowel (including small bowel enteroclysis) and enema (both conventional and double contrast) for colon.
- Other investigations done using fluoroscopic guidance - fistulogram, sinogram, t-tube cholangiography, sialography etc.
- Examination of liver, biliary system and pancreas using all the imaging modalities available to a radiologist including specialized investigations like ERCP, PTC and interventional procedures like abscess drainage, percutaneous trans hepatic biliary drainage (PTBD, internal and external), tumor embolization, radiofrequency(RFA) ablation etc.
- Indications and limitations of ultrasound, CT and MR
- Understand indications, limitations and contraindications of various interventional radiology techniques

- Diseases and disorders of GIT, omentum, peritoneum and mesentery. Diseases and disorders of hepato-biliary-pancreatic system. Conventional and other imaging methods like US, CT, MRI, DSA and isotope studies pertaining to these systems.
- The Abdomen : Normal appearance, abdominal calcification, acute abdomen, pneumoperitoneum, post operative abdomen, Intraperitoneal fluid, inflammatory conditions, intraabdominal abscesses, intramural gas and other conditions.
- The Esophagus-anatomy and normal appearances, radiological investigation like barium, usg, including endovascular, CT, MRI. diseases- hiatus hernia, oesophagitis, neoplasm, esophageal Varices, associated dermatological conditions, trauma, esophageal web, motility disorders, esophageal diverticulum, extrinsic esophageal compression, post operative changes, scintigraphy.
- The Stomach - anatomy and normal appearances, radiological and imaging investigations, inflammatory diseases, tumors, structural and functional abnormalities, extrinsic masses, post operative stomach- USG, CT, MRI, examination, radionuclide studies.
- The Duodenum and small bowel-anatomy and normal appearances, radiological investigations (Barium meal follow through, enteroclysis, CT, MRI, with CT/MRI enteroclysis, virtual endoscopy). diseases- neoplasms, infections, and infestations, radiation enteritis, mechanical small bowel intestinal obstruction, ischemia, intramural hemorrhage, diverticulitis, and blind loop, neuromuscular disorders, malabsorption syndromes, immunological disorders, radionuclide studies of small bowel.
- Large Bowel-Anatomy, colonic function, investigations like (Barium, CT, MRI, Colonography, virtual colonoscopy), diseases- tumors, diverticular diseases, colitis, miscellaneous conditions, appendicitis, Scintigraphic detection of bleeding,

Abdominal imaging-

- Liver: gross anatomy, plain film diagnosis, investigations like USG, CT, MRI, MRCP, PTC, ERCP, T-tube cholangiography, vascular studies, hepatobiliary interventions., portal hypertension, focal masses, diffuse liver disease, inflammatory disease of liver, gall bladder and biliary diseases, gall bladder masses, radiology in liver transplantation. Radiology of spleen pancreas, peritoneum and mesentery, Pancreas; embryology, radiological

anatomy, techniques of examination, radiological diagnosis and interventional treatment.

- GI manifestation of AIDS; Radiological evaluation, techniques, lesions, oesophagitis, lesions involving stomach, small bowel, colon, biliary tract, lymphadenopathy.
- GI angiography – general considerations, celiac and hepatic, pancreatic, SMA & IMA angiography, GI bleeding, angiography in portal hypertension, PTA and mesenteric ischemia.
- Newborn and young infant: lesions causing obstruction, atresia, gastric, antral or pyloric atresia, small bowel atresia, anal atresia and imperforate anus, anomalies of rotation and mid gut volvulus, enteric duplication, hypertrophic pyloric stenosis, gastro esophageal reflux and hiatus hernia, Hirschsprung's disease, colonic immaturity, neonatal small left colon syndrome, meconium plug syndrome, meconium ileus, intussusceptions, necrotizing enterocolitis
- Role of Imaging in Fetal Medicine
- Acute abdomen - investigations and interpretations with abdominal trauma imaging
- Radiology of Post-operative abdomen and organ transplantation (Liver, Pancreas, etc.)
- Ischemic conditions of Bowel and Mesentery and role of arteriography and Doppler study
- Upper and lower GI bleeding and GI radiological investigations including scintigraphy
- GI manifestation of AIDS; Radiological evaluation, techniques, lesions, esophagitis, lesions involving stomach, small bowel, colon, biliary tract, lymphadenopathy

ENDOCRINE DISEASE

- Introduction, Pathophysiology, radiological techniques, hypothalamus, pineal, pituitary, thyroid, para thyroid, thymus, pancreas, GI tumors, adrenal, female reproductive system, male reproductive system

GENITO-URINARY SYSTEM –

- Applied anatomy to interpret uro-gynaecological imaging
- Clinical significance of pathology associated with presentation and link with likely diagnoses
- Knowledge of local/regional guidelines in relation to clinical presentation
- Various diseases and disorders of genito-urinary system including congenital, inflammatory, infectious, traumatic, neoplastic, calculus disease and miscellaneous conditions.
- Performance, direction and interpretation of the conventional radiological examinations of the urinary tract including: intravenous urography; cystograms, micturating cystourethrography (MCU), hysterosalpingography (HSG) and retrograde urethrography (RGU).
- Diagnostic imaging modalities and procedures which are used to evaluate urinary tract pathology i.e. Ultrasound, CT, MRI, angiography, as well as various interventional procedures like percutaneous nephrostomy, radio frequency ablation (RFA), kidney biopsy, stent placement, antegrade pyelography, tumor embolization etc.
- Emergency conditions involving the urinary tract including trauma, infection, vascular compromise and obstruction.
- Evaluation of renal mass lesions and the evaluation of other urinary tract neoplasms, including the detection and staging of the tumor.
- Recognition of the difference between the pattern of diseases affecting the genitourinary tract of adults and that of children and understand and identify the common conditions affecting the pediatric genito-urinary system on imaging.
- Evaluation of renal failure & post-transplant kidney.
- Miscellaneous including cystic disease of kidney, nephrocalcinosis, lower urinary tract obstruction/infection and post-operative problems, male infertility imaging and interventions and trauma of genito-urinary tract
- Interventional Uroradiology – Percutaneous nephrostomy, renal cyst puncture, FNAC and ureteric stenting.

- The female reproductive system: ultrasound in obstetrics and gynecology, antenatal ultrasound including TIFFA, NT/NB , obstetric doppler evaluation , imaging in gynecology, MRI of female pelvis, radiological techniques in obstetrics and gynecology, congenital anomalies of female genital tract, inflammatory diseases, tumors of pelvis.
- Imaging in infertility with detailed knowledge of HSG
- Methods of investigation – plain films, IVU, MCU, ultrasound, CT scanning, MRI, MR-angiography, antegrade pyelography, retrograde pyelography, cavernosography, radionuclide imaging. Nuclear medicine in genitourinary tract, clearance techniques, dynamic renal scan, static renal scan, V-U reflux, role of radionuclide scanning in renal infections, Urodynamics, lower urinary tract studies, applications in bladder instability, urinary incontinence, outflow obstruction, neurogenic bladder, & upper urinary tract, disease.
- Renal parenchymal disease; anatomy, normal appearances, differential diagnosis, renal infections. Renal masses: modalities available for diagnosis, non-neoplastic renal masses, neoplastic renal masses - benign and malignant, calculus disease and urothelial lesions, nephrocalcinosis, other lesions, staging of upper urinary tract tumors, staging of bladder tumors.
- Urinary obstruction: Pathophysiology, diagnosis by different modalities, non obstructive dilatation, causes of obstruction, urinary bladder; normal anatomy, radiological evaluation, pathologies, prostate: Normal anatomy, radiological investigations, congenital processes, infection, calculi, tumors, BHP, carcinoma. Reno vascular hypertension, renal arteriography, Reno vascular disorders, Reno vascular HT - etiology, management, investigative strategy, identification of renal artery stenosis, significance of renal artery stenosis, radiological treatment of Reno vascular hypertension, PTA, embolization in Reno vascular HT. Injuries to urinary tract-kidney, ureter, bladder and urethra classification of renal injuries, principles of management, evaluation, imaging, modalities, radiological findings, complications. Renal failure and transplantation; renal size and collecting system dilatation, diagnosis of causes of failure, transplant - investigation of donor, IVU, vascular studies, radionuclide imaging, evaluation of recipient, surgical techniques, transplant kidney – radionuclide imaging, ultrasound, angiography, CT, MRI and complications of transplantation.
- Paediatric uroradiology: introduction, techniques, embryology, congenital anomalies, neonatal conditions, infections and V-U reflux, hypertension in a child, renal tumors in childhood.

MUSCULOSKELETAL SYSTEM

- Skeletal Trauma: General conditions, spine: cervical, thoracolumbar, pelvis and acetabulum, appendicular skeleton. General classification of bone lesions, benign tumors & cysts of bone, giant cell tumors, tumors of fibrous origin, other tumors, tumor like conditions synovial tumors, malignant bone tumors, metastatic lesions, primary malignant tumors,– chondral origin, osteoid origin, fibrous origin, marrow origin, notochord origin, synovial origin, other tumors.
- Bone and joint infections: periostitis and osteomyelitis, chronic osteomyelitis, bone and joint infections, in neonates, infections arthritis, granulomatous arthritis, parasitic and fungal infections, viral disorders, sarcoidosis, diabetic osteopathy, infected prostheses.
- Metabolic and endocrine diseases of the skeleton, anatomy, and physiology; increase and decrease in the bone density, generalized or localized; quantitative bone mineral analysis. Skeletal dysplasia's; normal bone growth, disorders affecting growth plate, disorders affecting epiphysis and apophyses metaphyses, diaphyses, mucopolysaccharidoses, mucopolipidoses, miscellaneous conditions including neurofibromatosis and Paget's disease, chromosomal disorders; Cranio – vertebral instability, joint disorders, Patho physiological concept and diagnostic approach Inflammatory (synovial) arthropathies, connective tissue disorders, crystal deposition arthropathies, degenerative joint arthropathies, degenerative disease of spine, arthrography, radiology of soft tissues; imaging techniques, focal lesions, calcification and ossification. Gas in soft tissue, soft tissues tumors; musculo skeletal system in children-development and nutrition; Congenital anomalies and bone Dysplasia, inflammatory neoplastic, traumatic, endocrine, metabolic and systemic skeletal disorders in children; radiology of child abuse;
- Musculo Skeletal CT (computed tomography), techniques aspects of clinical applications; in trauma; musculo skeletal infections neoplasm's and low-back pain syndromes, quantitative bone mineral analysis, uses in joint diseases, CT-based interventional techniques
- Musculo skeletal MR (Magnetic Resonance Imaging), normal signals, bone marrow-reconversion, infiltration or, replacement, bone marrow edema, myeloid depletion, bone ischemia, bone tumor imaging, joint imaging; Radio-nuclide bone imaging: Technique, normal bone scan, specific applications.
- Ultrasound in Musculoskeletal system for assessment of muscular, tendinous and ligamentous pathologies and joint.

CENTRAL NERVOUS SYSTEM:

- Methods of examination and diagnostic approach; cranial and intracranial pathologies, intracranial tumors- supra and infratentorial, pituitary tumors, intracranial infections, degenerative disorders, demyelinating disorders, cerebro-vascular ischemia, intracranial vascular abnormalities, HIV infections- cerebral complications.
- Spine: methods and diagnostic approach. Plain Radiography, CT, MRI, Myelography, spinal angiography. Radionuclide imaging of CNS- Radiopharmaceutical and bloodbrain barrier(BBB), scintigraphy, radionuclide arteriography, positron emission tomography(PET), receptor imaging, monoclonal body imaging, ultrasound of infant brain.

OPHTHALMOLOGY, ENT and FACE; maxillofacial and dental radiology

- Orbits: anatomy and techniques, intraocular abnormalities, orbital pathology, orbital trauma, inflammatory disease, space occupying lesions;
- Nose and Para nasal sinuses, Ear-Anomalies or development, methods of investigation, HRCT temporal, anatomy and diseases, MRI for inner ear, mouth, pharynx and larynx, Para pharyngeal spaces.
- Ocular ultrasound and its applications in detection of posterior segment diseases
- Neck anatomy on various modalities and diseases and application of various imaging modalities like CT, MRI, and Isotope studies, PET, SPECT etc
- Neck spaces anatomy in relevance to spread of various diseases across different spaces and compartments.
- Diseases Involving larynx- congenital, infectious, inflammatory and neoplastic
- Malignant & benign neoplastic diseases of head and neck region
- MRI for inner ear, mouth, pharynx and larynx, Para pharyngeal spaces.
- Maxillofacial pathology, fracture, benign lesions, malignant lesions, differential diagnosis of radiolucent and radio opaque lesions,

abnormalities of growth and development, temporomandibular joint, salivary glands, soft tissue calcification, dental radiology, anatomy of teeth and supporting structure

- Dental radiology, anatomy of teeth and supporting structure ,Developmental anomalies, eruption of teeth, dental caries, pulpitis and periapical infection, periodontal disease, fracture of teeth and alveolar bone, resorption of teeth, Neck anatomy on various modalities and diseases.

Reticuloendothelial Disorders

- Lymphoma-pathology and imaging, spleen- Imaging, interventional techniques
- Imaging in oncology-General methods in oncological diagnosis, staging and follow-up, ovarian tumors, nonseminomatous germ cell tumor, colorectal cancers, lung cancer and others
- Radiotherapy, treatment planning, interventional radiology-complication and treatment, radionuclide imaging in oncology, HIV infection and AIDS(Acquired immunodeficiency syndrome), background, epidemiology, treatment pathogenesis, natural history diagnosis complication and treatment
- Myeloproliferative disorders: red blood cell disorders, chronic hemolytic anemia's, other anemia's and bone marrow dyscrasias, white cell disorders, lymphoma, plasma cell disorders, reticulo- endothelial disorders, hemophilia and other bleeding disorders

Angiography –intervention and other techniques

- Embolization, Percutaneous Trans luminal angioplasty, regional arteriography, head and neck, thorax, abdomen, upper and lower extremity angiography, angiography for endocrinal glands.

Venography

- Technique and complications ,regional venography of head and neck, thorax and abdomen-SVC venography,IVC venography, Azygos and ascending lumbar venography, Mesenteric and portal venography,

gonadal venography, pelvic venography, venous sampling, interventional technique in venous system.

Vascular Imaging

- Doppler Ultrasound, clinical applications, volumetric flow measurements, color- flow imaging, artifacts, error and pitfalls, power Doppler and endovascular ultrasound
- Interventional radiology: informed consent, biopsy procedures
- Percutaneous decompression, extraction and drainage
- Image guided therapy
- Interventional vascular techniques
- Percutaneous techniques for vascular extractions impact on medicine and radiology

The Breast:

- Understand anatomy and physiology of breast, changes with age and patterns of disease spread and principles of differentiation between normal breast, benign and malignant disease
 - Physics of image production and how it affects image quality with respect to mammography, ultrasound & breast MRI with indications for and determining optimal imaging examination
 - Clinical presentation, pathogenesis and basic principles of treatment of breast disease
 - Role of conventional and digital mammography in screening of breast cancer, benign and malignant lesions of the breast
 - Interpretation of mammograms
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- Understand basic principles underlying population screening and assessment of screen detected abnormalities
 - Breast ultrasound - discriminate cystic v solid mass; recognize typical features of benign and malignant masses; identify and discriminate between normal and abnormal axillary lymph nodes.
 - Image guided cyst aspiration, abscess drainage, fine needle aspiration and core biopsy under supervision, Vacuum assisted biopsy (VAB), stereotactic FNAC and biopsy, ductography.
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- BIRADS and New BIRADS system for lesion characterization and quality assurance
 - MRI breast with emphasis on use of volume MR with newer sequences in breast imaging like DWI & PWI
 - Breast tomosynthesis
 - Role of breast cancer screening and guidelines
 - The mammographic technique, equipment and quality control, indications for mammography, normal anatomy, benign conditions, carcinoma, calcifications, breast screening, lesion localization, breast ultrasound. Role of MRI, PET, thermography, Elastography, CT, Image guided interventions for diagnosis and therapy of breast lesions
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Diagnostic Techniques and General Conditions-

- Picture archiving and communication systems and digital radiology, intravascular iodinated contrast media, general principles of ultrasound, vascular ultrasound, recent developments in whole body Computed tomography, Basic principles of Magnetic Resonance Imaging, General Principles of Radionuclide imaging, dual energy X-ray absorptionmetry, functional imaging, medico legal issues in diagnostic and interventional radiology, patient dosage and radiation protection in diagnostic imaging ,cost benefit.

Radiology Emergency Medicine

- The student should be able to evaluate emergency radiographic examinations with reasonable accuracy and have clear understanding of the protocol of imaging in emergency situations of different organ systems.

Diagnostic Techniques

General Radiology

The student should be able to evaluate conventional radiographs including radiographs on chest abdomen, pelvis, skull (including PNS+Orbit), spine, musculoskeleton and soft tissues. Student should be able to perform radiography of different body parts.

Ultrasound

The student should be able to perform and interpret all ultrasound studies. These studies include: abdomen, pelvis, small parts, neonatal head, breast, color duplex imaging (arterial and venous studies), obstetric/gynecology and intervention procedures using ultrasound guidance.

CT

- Select CT protocol according to the clinical diagnosis.
- Demonstrate knowledge of the CT finding of the common pathological conditions.
- Interpret conventional and modified body CT examinations like HRCT, dual/triple phase, Vertical CT etc.
- Know limitations of CT in the diagnosis of certain diseases.
- Perform CT guided simple interventions (under supervision)

Angiography

Should be able to perform (under supervision) and interpret routine angiographic procedures and vascular interventions.

MRI

- Select MRI protocol according to the clinical diagnosis
- Knowledge of conventional and modified MRI examinations, including MRA, MRV, MRCP, MRS.
- Demonstrate knowledge of the MRI of the common pathological conditions.
- Mammography and Breast Intervention

Interventional Radiology

The student should be able to perform (under supervision) simple interventional procedures of all the organ systems.

- Vascular interventional radiologic procedures such as Percutaneous transluminal angioplasty, stenting, embolization using various embolic material and arterial & venous thrombolysis.
 - Various non-vascular interventional procedures such as percutaneous nephrostomy, stenting, abscess drainage, PTC/PTBD, biliary stenting percutaneous US/CT guided biopsy, balloon dilatation of the esophagus etc
 - Regional arteriography of head and neck, thorax, abdomen, upper and lower extremities.
 - Venography; technique and complications , regional venography of head and neck, thorax and abdomen-SVC venography, IVC venography, Portal venography, gonadal venography, pelvic venography, venous sampling, interventional technique in venous system
 - Trans arterial chemoembolization & Trans arterial radio embolization – indications, technique and complications
 - Doppler evaluation and endovascular management of varicose veins
 - Neurointerventions in stroke. Aneurysm , AVM, fistula
 - Bone biopsy
 - Radiofrequency ablation : indications, techniques and contraindications
 - Digital subtraction angiography: equipment, applications ,
 - Radiation protection during interventional procedures
-

RECENT ADVANCES IN RADIOLOGY

ONCOLOGIC RADIOLOGY

- At the end of the rotation the resident should be able to interpret radiological investigations in patients with neoplastic diseases (both benign and malignant)
- Understand pathology and patho-physiology of common neoplasms.
- Learn the algorithmic approach to image these patients based on the suspected disease, its biological behavior and potential and limitations of various imaging modalities.
- Perform appropriate investigation (both conventional and newer methods), interpret the results and reach at a reasonable diagnosis/ differential diagnosis based on the clinical and biochemical results.
- Learn to communicate the results in a precise way in a written report to the concerned unit.

NUCLEAR MEDICINE

- At the completion of this rotation the resident should be able to interpret common nuclear medicine examinations (including cardiac cases).
- Student should be able to evaluate the examinations for completion and determine what further images (including non nuclear medicine) need to be done.
- Student should have a good understanding of the physical and biological properties of the commonly used radiopharmaceuticals and become familiar with safe handling of isotopes and basic radiation safety measures while dealing with isotopes.

Biostatistics, Research Methodology and Clinical Epidemiology

Ethics

Medico legal aspects relevant to the discipline

Health Policy issues as may be applicable to the discipline

PRACTICALS

Physics

- Film characteristics
- Effectiveness of Lead Apron and other protective Devices
- Beam parameters check
- Optical Radiation field alignment
- Assessment of Scatter radiation
- Quality control of X-rays and Imaging equipments
- Evaluation of performance of a film processing unit

Practical radiography

- Dark room techniques
- Radiography of the extremities
- Radiography of the spine, abdomen, pelvic girdle and thorax
- Radiography of the skull
- Contrast techniques and interpretation of GI tract, biliary tract, etc.
- Contrast techniques and interpretation of the Genito-urinary system
- Contrast techniques and interpretation of the central nervous and cardiovascular system
- Miniature radiography, Macro-radiography and magnification techniques
- Dental and portable radiography

Anatomy

Gross and cross sectional Anatomy of all the body systems

Pathology

Gross morphology of pathological condition of various systems

Contrast Media

Their types, formulations, mechanism of action, dose schedule, routes of administration, adverse reactions and their management.

Competencies

General Principles

Acquisition of practical competencies being the keystone of postgraduate medical education, postgraduate training is skill oriented. Learning in postgraduate program is essentially self directed and primarily emanating from clinical and academic work. The formal sessions are merely meant to supplement this core effort.

Teaching Sessions

In addition to conducting and reporting of routine and special investigation in the area of posting under direct supervision, formal teaching session to be held on working days. These include seminars in physics and general radiology, journal clubs, case presentations; Interdepartmental meets, Film reading session.

Teaching Schedule

The suggested departmental teaching schedule is as follows:

1. Seminar
2. Film Reading
3. Case presentation
4. Inter department meet
5. Journal club
6. Statistical meetings: Weekly./ monthly
7. Mortality meetings
8. Interdepartmental Meetings
9. Film Reading / Physics Seminar

Note

- All sessions will be co-ordinate by the faculty members.
- All the teaching sessions to be assessed by the consultants at the end of session and graded
- Attendance of the Residents at various sessions should be at least 75%

Posting

The postgraduate student should be posted in all sections (Conventional radiology, U/S, CT, MRI etc.) so that there is adequate exposure to all modalities. The proposed duration of postings is as under.

- Conventional 10 to 14 months
- U/S 10 to 12 months
- CT / MRI 10 to 12 months

SCHEDULE FOR ROTATION OF RESIDENTS

1st Year	Musculoskeletal	Emergency	US	US	Chest	Chest
	GU	GU	GIT	GIT	CT	CT
2nd Year	US	US	Chest	Musculoskeletal	Emergency	Emergency
	CT	CT	Intervention US / CT	US	MRI	MRI
3rd Year	GIT	GIT	US	US/CT Intervention	CT	CT
	MRI	MRI	US	Chest	Elective	Elective

Radiological Procedure which the candidates must know

S No.	Name of Procedure	As Observer	As first assistant	Independently under supervision
	RADIODIAGNOSIS			
1	Dark room(each step)	20	20	100
2	CYR & apicogram & H-virus, decabities	20	20	50
3	Other X-rays(extremities & spine)	20	20	20
4	Skull	100	50	100
5	Fluroscopy	50	50	50
6	Barium Swallow BMUGI BMFT (& Enteroclysis) B enema	10	10	50
7	IVP, MCU, RGU	10	10	30
8	Tube based procedures	20	20	20

	<ul style="list-style-type: none"> nephrostomy-T tube sinogram, fistulogram 			
9	Drainage procedures	10	10	50
10	Biopsy / FNAC	10	10	50
11	Doppler	50	100	100
12	TRUS, TVS	50	50	100
13	Neonatal cranial USG	10	20	20

Radiological procedures which the candidates may know/desirable

Name of procedure
RADIO DIAGNOSIS
CT enteroclysis Dark
MR enteroclysis
Diffusion & perfusion & MRS
Angiography <ul style="list-style-type: none"> CT MR DSA
Sonourethrography
Bowel Ultrasound
USG contrast
Transcath
Interventional Radiology
Nuclear Imaging <ul style="list-style-type: none"> Echocardiography Angiography

Investigations/ tests which the candidates must know to interpret

Name of Investigations
ERCP
PTC
Arteriography/Venography
CT cisternography
CT Myelography, Myelogram
MRCT
MRCP
CT/MR Angiogram/ Venogram

THESIS PROTOCOL & THESIS

The candidates are required to submit a thesis at the end of three years of training as per the rules and regulations of NBE.

Guidelines for Submission of Thesis Protocol & Thesis by candidates

Research shall form an integral part of the education programme of all candidates registered for DNB degrees of NBE. The Basic aim of requiring the candidates to write a thesis protocol & thesis/dissertation is to familiarize him/her with research methodology. The members of the faculty guiding the thesis/dissertation work for the candidate shall ensure that the subject matter selected for the thesis/dissertation is **feasible, economical and original**.

Guidelines for Thesis Protocol

The protocol for a research proposal (including thesis) is a study plan, designed to describe the background, research question, aim and objectives, and detailed methodology of the study. In other words, the protocol is the 'operating manual' to refer to while conducting a particular study.

The candidate should refer to the NBE Guidelines for preparation and submission of Thesis Protocol before the writing phase commences. The minimum writing requirements are that the language should be clear, concise, precise and consistent without excessive adjectives or adverbs and long sentences. There should not be any redundancy in the presentation.

The development or preparation of the Thesis Protocol by the candidate will help her/him in understanding the ongoing activities in the proposed area of research. Further it helps in creating practical exposure to research and hence it bridges the connectivity between clinical practice and biomedical research. Such research exposure will be helpful in improving problem solving capacity, getting updated with ongoing research and implementing these findings in clinical practice.

Research Ethics: Ethical conduct during the conduct and publication of research is an essential requirement for all candidates and guides, with the primary responsibility of ensuring such conduct being on the thesis guide. Issues like Plagiarism, not maintaining the confidentiality of data, or any other distortion of the research process will be viewed seriously. The readers may refer to standard documents for the purpose.

The NBE reserves the right to check the submitted protocol for plagiarism, and will reject those having substantial duplication with published literature.

PROTOCOL REQUIREMENTS

1. All of the following will have to be entered in the online template. The thesis protocol should be restricted to the following word limits.
 - Title : 120 characters (with spacing) page
 - Synopsis [structured] : 250-300
 - Introduction : 300-500
 - Review of literature : 800-1000
 - Aim and Objectives : Up to 200
 - Material and Methods : 1200-1600
 - 10-25 References [ICMJE style]
2. It is mandatory to have ethics committee approval before initiation of the research work. The researcher should submit an appropriate application to the ethics committee in the prescribed format of the ethics committee concerned.

Guidelines for Thesis

1. The proposed study must be approved by the institutional ethics committee and the protocol of thesis should have been approved by NBE.
2. The thesis should be restricted to the size of 80 pages (maximum). This includes the text, figures, references, annexures, and certificates etc. It should be printed on both sides of the paper; and every page has to be numbered. Do not leave any page blank. To achieve this, following points may be kept in view:
 - a. The thesis should be typed in 1.5 space using Times New Roman/Arial/ Garamond size 12 font, 1” margins should be left on all four sides. Major sections viz., Introduction, Review of Literature, Aim & Objectives, Material and Methods, Results, Discussion, References, and Appendices should start from a new page. Study proforma (Case record form), informed consent form, and patient information sheet may be printed in single space.
 - b. Only contemporary and relevant literature may be reviewed. Restrict the introduction to 2 pages, Review of literature to 10-12 pages, and Discussion to 8-10 pages.
 - c. The techniques may not be described in detail unless any modification/innovations of the standard techniques are used and reference(s) may be given.
 - d. Illustrative material may be restricted. It should be printed on paper only. There is no need to paste photographs separately.

3. Since most of the difficulties faced by the residents relate to the work in clinical subject or clinically-oriented laboratory subjects, the following steps are suggested:
 - a. The number of cases should be such that adequate material, judged from the hospital attendance/records, will be available and the candidate will be able to collect case material within the period of data collection, i.e., around 6-12 months so that he/she is in a position to complete the work within the stipulated time.
 - b. The aim and objectives of the study should be well defined.
 - c. As far as possible, only clinical/laboratory data of investigations of patients or such other material easily accessible in the existing facilities should be used for the study.
 - d. Technical assistance, wherever necessary, may be provided by the department concerned. The resident of one specialty taking up some problem related to some other specialty should have some basic knowledge about the subject and he/she should be able to perform the investigations independently, wherever some specialized laboratory investigations are required a co-guide may be co-opted from the concerned investigative department, the quantum of laboratory work to be carried out by the candidate should be decided by the guide & co-guide by mutual consultation.
4. The clinical residents are not ordinarily expected to undertake experimental work or clinical work involving new techniques, not hitherto perfected OR the use of chemicals or radioisotopes not readily available. They should; however, be free to enlarge the scope of their studies or undertake experimental work on their own initiative but all such studies should be feasible within the existing facilities.
5. The DNB residents should be able to freely use the surgical pathology/autopsy data if it is restricted to diagnosis only, if however, detailed historic data are required the resident will have to study the cases himself with the help of the guide/co-guide. The same will apply in case of clinical data.
6. Statistical methods used for analysis should be described specifically for each objective, and name of the statistical program used mentioned.

General Layout of a DNB Thesis:

- **Title-** A good title should be brief, clear, and focus on the central theme of the topic; it should avoid abbreviations. The Title should effectively summarize the proposed research and should contain the PICO elements.

- **Introduction-** It should be focused on the research question and should be directly relevant to the objectives of your study.
- **Review of Literature** - The Review should include a description of the most relevant and recent studies published on the subject.
- **Aim and Objectives** - The 'Aim' refers to what would be broadly achieved by this study or how this study would address a bigger question / issue. The 'Objectives' of the research stem from the research question formulated and should at least include participants, intervention, evaluation, design.
- **Material and Methods-** This section should include the following 10 elements: Study setting (area), Study duration; Study design (descriptive, case-control, cohort, diagnostic accuracy, experimental (randomized/non-randomized)); Study sample (inclusion/exclusion criteria, method of selection), Intervention, if any, Data collection, Outcome measures (primary and secondary), Sample size, Data management and Statistical analysis, and Ethical issues (Ethical clearance, Informed consent, trial registration).
- **Results-** Results should be organized in readily identifiable sections having correct analysis of data and presented in appropriate charts, tables, graphs and diagram etc.
- **Discussion**—It should start by summarizing the results for primary and secondary objectives in text form (without giving data). This should be followed by a comparison of your results on the outcome variables (both primary and secondary) with those of earlier research studies.
- **Summary and Conclusion-** This should be a précis of the findings of the thesis, arranged in four paragraphs: (a) background and objectives; (b) methods; (c) results; and (d) conclusions. The conclusions should strictly pertain to the findings of the thesis and not outside its domain.
- **References-** Relevant References should be cited in the text of the protocol (in superscripts).
- **Appendices** -The tools used for data collection such as questionnaire, interview schedules, observation checklists, informed consent form (ICF), and participant information sheet (PIS) should be attached as appendices. Do not attach the master chart.

Thesis Protocol Submission to NBE

1. DNB candidates are required to submit their thesis protocol within 90 days of their joining DNB training.
2. Enclosures to be submitted along with protocol submission form:
 - a) Form for Thesis Protocol Submission properly filled.
 - b) Thesis Protocol duly signed.
 - c) Approval letter of institutional Ethical committee. (*Mandatory, non receivable of any one is liable for rejection*)

Thesis Submission to NBE

1. As per NBE norms, writing a thesis is essential for all DNB candidates towards partial fulfillment of eligibility for award of DNB degree.
2. DNB candidates are required to submit the thesis before the cut-off date which shall be 30th June of the same year for candidates appearing for their scheduled December final theory examination. Similarly, candidates who are appearing in their scheduled June DNB final examination shall be required to submit their thesis by 31st December of preceding year.
3. Candidates who fail to submit their thesis by the prescribed cutoff date shall NOT be allowed to appear in DNB final examination.
4. Fee to be submitted for assessment (In INR): 3500/-
5. Fee can be deposited ONLY through pay-in-slip/challan at any of the Indian bank branch across India. The challan can be downloaded from NBE website www.natboard.edu.in
6. Thesis should be bound and the front cover page should be printed in the standard format. A bound thesis should be accompanied with:
 - a. A Synopsis of thesis.
 - b. Form for submission of thesis, duly completed
 - c. NBE copy of challan (in original) towards payment of fee as may be applicable.
 - d. Soft copy of thesis in a CD duly labeled.
 - e. Copy of letter of registration with NBE.
7. A declaration of thesis work being bonafide in nature and done by the candidate himself/herself at the institute of DNB training need to be submitted bound with thesis. It must be signed by the candidate himself/herself, the thesis guide and head of the institution, failing which thesis shall not be considered.

The detailed guidelines and forms for submission of Thesis

Protocol & Thesis are available at

www.natboard.edu.in.thesis.php

LOG BOOK

A candidate shall maintain a log book of operations (assisted / performed) during the training period, certified by the concerned post graduate teacher / Head of the department / senior consultant.

This log book shall be made available to the board of examiners for their perusal at the time of the final examination.

The log book should show evidence that the before mentioned subjects were covered (with dates and the name of teacher(s)) The candidate will maintain the record of all academic activities undertaken by him/her in log book .

1. Personal profile of the candidate
2. Educational qualification/Professional data
3. Record of case histories
4. Procedures learnt
5. Record of case Demonstration/Presentations
6. Every candidate, at the time of practical examination, will be required to produce performance record (log book) containing details of the work done by him/her during the entire period of training as per requirements of the log book. It should be duly certified by the supervisor as work done by the candidate and countersigned by the administrative Head of the Institution.
7. In the absence of production of log book, the result will not be declared.

Leave Rules

1. DNB/FNB Trainees are entitled to avail leave during the course of DNB/FNB training as per the Leave Rules prescribed by NBE.
2. A DNB/FNB Trainees can avail a maximum of 30 days of leave in a year excluding regular duty off/ Gazetted holidays as per hospital/institute calendar/policy. This leave shall be processed at the institutional level.
3. Any kind of study leave is not permissible to DNB/FNB Trainees.
4. Under normal circumstances leave of one year should not be carried forward to the next year. However, in exceptional cases such as prolonged illness, the leave across the DNB/FNB training program may be clubbed together with prior approval of NBE.
5. Unauthorized absence from DNB/FNB training for more than 7 days may lead to cancellation of registration and discontinuation of the DNB/FNB training and rejoining shall not be permitted.
6. Any Leave availed by the candidate other than the eligible leave (30 days per year) shall lead to extension of DNB /FNB training. The training institute has to forward such requests to NBE along with the leave records of the candidate since his/her joining and supporting documents (if any) through the Head of the Institute with their recommendation/comments. NBE shall consider such requests on merit provided the seat is not carried over and compromise with training of existing trainees in the Department.
7. Any extension of DNB/FNB training beyond the scheduled completion date of training is permissible only under extra-ordinary circumstances with prior approval of NBE. Such extension is neither automatic nor shall be granted as a matter of routine.
8. DNB/FNB trainees are required to complete their training by a prescribed cutoff date (as per information bulletin of Exit exam) for being eligible to DNB/FNB Exit examination.
9. The eligibility for DNB/FNB Final Examination shall be determined strictly in accordance with the criteria prescribed in the respective information bulletin.

10. candidates join on or after 2018 can avail Maternity / Paternity leave, as per the Central or State Government policies, whichever is applicable to DNB/FNB training institute.
11. DNB/FNB trainees are eligible for stipend either during the leave period or extension of training period as per the policies of DNB/FNB training institute and prevailing rules.

EXAMINATION

FORMATIVE ASSESSMENT

Formative assessment includes various formal and informal assessment procedures by which evaluation of student's learning, comprehension, and academic progress is done by the teachers/ faculty to improve student attainment. Formative assessment test (FAT) is called as "Formative" as it informs the in process teaching and learning modifications. FAT is an integral part of the effective teaching. The goal of the FAT is to collect information which can be used to improve the student learning process.

Formative assessment is essentially positive in intent, directed towards promoting learning; it is therefore part of teaching. Validity and usefulness are paramount in formative assessment and should take precedence over concerns

for reliability. The assessment scheme consists of Three Parts which has to be essentially completed by the candidates.

The scheme includes:-

Part I:- Conduction of theory examination

Part-II :- Feedback session on the theory performance

Part-III :- Work place based clinical assessment

Scheme of Formative assessment

PART – I	CONDUCT OF THEORY EXAMINATION	Candidate has to appear for Theory Exam and it will be held for One day.
PART – II	FEEDBACK SESSION ON THE THEORY PERFORMANCE	Candidate has to appear for his/her Theory Exam Assessment Workshop.
PART – III	WORK PLACE BASED CLINICAL ASSESSMENT	After Theory Examination, Candidate has to appear for Clinical Assessment.

The performance of the resident during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student

1. Personal attributes:

- **Behavior and Emotional Stability:** Dependable, disciplined, dedicated, stable in emergency situations, shows positive approach.
- **Motivation and Initiative:** Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.
- **Honesty and Integrity:** Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.
- **Interpersonal Skills and Leadership Quality:** Has compassionate attitude towards patients and attendants, gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

2. Clinical Work:

- **Availability:** Punctual, available continuously on duty, responds promptly on calls and takes proper permission for leave.
- **Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in clinical case work up and management.
- **Academic ability:** Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.

- **Clinical Performance:** Proficient in clinical presentations and case discussion during rounds and OPD work up. Preparing Documents of the case history/examination and progress notes in the file (daily notes, round discussion, investigations and management) Skill of performing bed side procedures and handling emergencies.

3. Academic Activity: Performance during presentation at Journal club/ Seminar/ Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.

FINAL EXAMINATION

The summative assessment of competence will be done in the form of DNB Final Examination leading to the award of the degree of Diplomate of National Board in Radio Diagnosis. The DNB final is a two-stage examination comprising the theory and practical part. An eligible candidate who has qualified the theory exam is permitted to appear in the practical examination.

Theory Examination

1. The theory examination comprises of **Four** papers, maximum marks 100 each.
2. There are 10 short notes of 10 marks each, in each of the papers. The number of short notes and their respective marks weightage may vary in some subjects/some papers.
3. Maximum time permitted is 3 hours.
4. Candidate must score at least 50% in the aggregate of **Four** papers to qualify the theory examination.
5. Candidates who have qualified the theory examination are permitted to take up the practical examination.
6. The paper wise distribution of the Theory Examination shall be as follows:

Paper I

- Principles and practice of Radio diagnosis pertinent to Central Nervous System, Head and neck, Endocrine system, Musculo skeletal system and soft tissues

Paper II

- Principles and practice of Radio diagnosis pertinent to chest with a focus on Pulmonary and Cardiovascular Radiology

- Arterial and venous Doppler and Emergency Radiology including Trauma Radiology.

Paper III

- Principles and practice of Radio diagnosis pertinent to Gastroenterology, Hepatopancreatobiliary system, Genitourinary system, Obstetric imaging and Gynecological Radiology

Paper IV

- Basic sciences as applied to Radio diagnosis
- Radiation physics and Radiation biology
- Physics of imaging
- Radiological procedures
- Contrast agents in radiation
- Forensic Radiology
- Research Methodology
- Nuclear Medicine
- Interventional Radiology
- Recent advances

a) Practical Examination:

1. Maximum Marks: 300.
2. Comprises of Clinical Examination and Viva.
3. Candidate must obtain a minimum of 50% marks in the Clinical Examination (including Viva) to qualify for the Practical Examination.
4. There are a maximum of three attempts that can be availed by a candidate for Practical Examination.
5. First attempt is the practical examination following immediately after the declaration of theory results.
6. Second and Third attempt in practical examination shall be permitted out of the next three sessions of practical examinations placed alongwith the next three successive theory examination sessions; after payment of full examination fees as may be prescribed by NBE.
7. Absentation from Practical Examination is counted as an attempt.

8. Appearance in first practical examination is compulsory;
9. Requests for Change in center of examination are not entertained, as the same is not permissible.
10. Candidates are required not to canvass with NBE for above.

Declaration of DNB Final Results

1. DNB final is a qualifying examination.
2. Results of DNB final examinations (theory & practical) are declared as PASS/FAIL.
3. DNB degree is awarded to a DNB trainee in the convocation of NBE.

RECOMMENDED TEXT BOOKS AND JOURNALS

MUST READ

- Sutton: Text book of Radiology and Imaging volume-I-II.
- Grainger and Allison's Diagnostic Radiology: Text book of Medical Imaging
- Haaga J.R.: Computed Tomography and MRI volume-I and II. PG
- Rumack: Diagnostic ultrasound volume I & II

REFERENCE BOOKS

- Lee: Computed body tomography with MRI volume-I & II
- Osborn A.G.: Diagnostic neuro-radiology
- Jacobson's: Radiology of skeletal disorders
- Gore Levine: Text book of Gastrointestinal Radiology
- Margulis: Alimentary tract radiology volume I & II
- Davidson's: Radiology of the kidney and Genito-urinary tract
- Clark: Positioning in radiology Dahnert: Radiology Review Manual
- Webb: High Resolution CT of the lung
- Som and Curtin: Head and neck imaging
- Stark and Bradley: Magnetic resonance imaging Volume I & II
- Scott W. Atlas: MR imaging of the brain and spine
- Mittelstaedt CA : General ultrasound
- Callen: Ultrasonography in obstetrics and gynaecology
- David Sutlon . Text book of Radiology & Imaging
- Lee Stanley
- Hagea
- Osborn
- Manju Pandey - Biostatistics

JOURNALS

- Indian Journal of Radiology
- Radiology
- Radiological Clinics of North America
- Seminars in U/S, CT and MRI
- American Journal of Neuro-Radiology
- Clinical Radiology
- Radiology
- Neuro Radiology
- Journal of USG, CT, MRI
- A J R
- Seminars in Roentgenology
- RCNA
