



ภาคผนวกที่ ๒
เนื้อหาของกรฝึกอบรม

เนื้อหาของกรฝึกอบรม/หลักสูตร แบ่งเป็น ๓ หมวด ดังนี้	หน้า
๑. ความรู้พื้นฐานทางวิทยาศาสตร์การแพทย์ที่เกี่ยวข้องกับทางรังสี	
๑.๑ Medical radiation physics	๑
๑.๒ Radiobiology	๑๔
๒. ความรู้ด้านรังสีวิทยา	
๒.๑ รังสีวิทยาวิจัญ เพิ่มเติมจากภาคผนวก ๑ ในระบบ	
Neuroradiology	
Neuroimaging	๑๕
Angiography and interventional neuroradiology	๒๕
Head and neck imaging	๒๖
Body interventional radiology	๓๕
Emergency radiology	๔๑
๒.๒ เวชศาสตร์นิวเคลียร์	๔๕
๒.๓ Radiation oncology	๔๗
๓. ความรู้ด้านการบูรณาการทั่วไป	๕๐



I. ความรู้พื้นฐานทางวิทยาศาสตร์การแพทย์ที่เกี่ยวข้องกับทางรังสี

1. MEDICAL RADIATION PHYSICS

1.1 Basic Radiation Physics

B1 Basic Nuclear Physics (2 hours)

1. Atomic mass and energy units: Electron volt (eV) and atomic mass unit (amu)
2. Electromagnetic radiation
3. Organization of the atom:
 - 3.1 Composition and structure
 - 3.2 Electron binding energy and Quantum energy levels
 - 3.3 Atomic emissions and nuclear emissions
4. Structure of nucleus:
 - 4.1 Nuclear particles and nuclear energy levels
 - 4.2 Nuclear force, binding energy and mass deficit
 - 4.3 Nuclear stability (Neutron-proton ratio: line of stability), even-odd nucleon relationships
5. Nomenclature: Nuclides, isobars, isotopes, isotones, isomers
6. Radioactive decay:
 - 6.1 Decay schemes
 - 6.2 Decay characteristics and symbols
7. Mathematics of radioactive decay:
 - 7.1 Physical half-life biological half-life, effective half-life
 - 7.2 Average life
 - 7.3 Parent-daughter relationship
8. Units of activity: Curie and Becquerel, specific activity

B2 Interaction of photon & electron with matter (2 hours)

1. Photon interactions
 - 1.1 Photoelectric interaction



- 1.2 Compton interaction
- 1.3 Pair Production
2. Probability for each interaction
 - 2.1 Cross section
 - 2.2 Factors affected each interaction
3. Importance of interaction related to radiation works
 - 3.1 Radiation diagnostic
 - 3.2 Radiation Therapy
 - 3.3 Nuclear medicine
4. Ionizing Radiation
5. Interaction of electron with matter
6. Parameter related to particle energy loss

B3 Radiation quantities and units (1 hour)

1. Ionization
2. Ionizing radiation
3. Nuclide
4. Energy deposition event
5. Measurement of radiation
6. Exposure
7. Kerma
8. Quantities of dose using in radiation protection
9. Radioactivity
10. Exposure rate from gamma emitters

B4 Production of X-rays (1 hour)

1. Bremsstrahlung
2. X – ray spectra
3. Characteristic x-rays
4. X-ray beam quality and quantity



5. Half value layer (HVL) of x-ray beam
6. Calculation of HVL and inverse square law
7. Anode materials and filtration
8. X-ray circuit waveform

B5 Quality of X- rays (1 hour)

1. The quality of x rays
2. Half value layer
3. Spectral distribution of x rays
4. Effect of filters on x ray beam
5. Measurement of half-value layer
6. Exponential attenuation
7. Equivalent photon energy
8. Energy and wave length of x rays
9. Hard and soft x rays

B6 Radiation dosimetry system (1 hour)

1. Ionization chamber
 - 1.1 Ionization method
 - 1.2 Free air chamber
 - 1.3 Thimble chamber
 - 1.3.1 Condenser chamber
 - 1.3.2 Farmer chamber
 - 1.3.3 Special chamber
 - Extrapolation chamber
 - Parallel plate chamber
 - 1.4 Environmental conditions
 - 1.5 Type of ionization chambers
 - 1.5.1 Pulse type ionization chamber
 - 1.5.2 Current type ionization chamber



- Ionization chamber
- Proportional counter
- Geiger Mueller counter

2. Colorimetry

3. Chemical dosimetry

4. Film dosimeter

4.1 Film components

4.2 Latent image

4.3 Optical density

4.4 Advantage

4.5 Disadvantage

5. Thermoluminescence dosimetry

5.1 Thermoluminescence fluorescence

5.2 Type of TLD

5.3 Apparatus for measuring thermoluminescence

5.4 Glow curve

5.5 Advantage

5.6 Disadvantage

6. Scintillation dosimeter

7. Semiconductor detector

B7 Basic knowledge of medical computer & application (1 hour)

1. Definition

2. Digital data

3. Components of computer

- Central processing unit
- Input / Output devices
- Storage devices
- Communication network (bus)



- Digital images
- 4. Computer vision
 - Mammography
 - Chest x-rays
- 5. Computer assisted radiation therapy
 - Treatment planning system
 - Digital reconstructed radiographs
 - Online portal images

B8 Diagnostic X-ray equipment (2 hour)

1. Direct and alternation current
2. Single-phase and three-phase circuits
3. High voltage circuit
4. Control panel components
5. Backup timer
6. High voltage components
7. High frequency circuits
8. Tube housing and envelope
9. Cathode
10. Grid controlled tubes
11. Tube and filament current
12. Anode
13. Line focus principle
14. Heel effect
15. Off-focus radiation
16. Focal spot blooming
17. Heat units
18. Heat Limit curve
19. Anode heat monitors



20. Tube life and warm-up procedures

B9 Screen film radiograph (1 hour)

1. Radiographic film
2. X-ray film processing
3. Intensifying screen and fluorescence screen

B10 Fluoroscopy (1 hour)

1. Introduction to fluoroscopy and radiography.
 - 1.1 Meaning
 - 1.2 Basic principle of the production of fluoroscopic and radiographic imaging
2. X-ray machines
 - 2.1 Composition of general or conventional radiographic machine
 - X-ray tube
 - Beam limiting devices
 - Tube support
 - High tension cable
 - High tension generator and circuit
 - Control tube or panel
 - X-ray table
 - 2.2 Composition of general or conventional fluoroscopic machine.
 - X-ray tube
 - X-ray tube carriage and screen holder
 - Fluorescent screen
 - Serial changer or spot film device
 - Additional accessories
 - 2.3 Image intensifier.
 - Principle and construction of x-ray image intensifier tube
 - Optical viewer and image distributor
 - Closed circuit television system, video tape recorder, cine camera,



photospot camera

- Care and maintenance of x-ray machines
- Radiation protection during the fluoroscopic and radiographic examination

B11 Computerized tomography (1 hour)

1. Components of a CT scanner
 - 1.1 The gantry
 - 1.2 X-ray circuit
 - 1.3 X-ray tube
 - 1.4 Radiation detectors
 - 1.5 Patient support table
 - 1.6 Computer system
 - 1.7 Operator's console
2. CT Numbers
3. Contrast resolution
4. Spiral CT scanning
5. Radiation dose from CT scanning
6. Radiation safety for radiation personals

B12 MRI (1 hour)

1. Principle of MRI
2. MR instrumentation
3. Basic MR pulse sequences (spin echo and gradient echo)
4. Type of MR images (T1w, T2w, PDw images)
5. Suppression and cancellation techniques
6. Safety

B13 Radiotherapy equipment (1 hour)

Basic principles and operations of radiotherapy equipment

1. Kilovoltage units
2. Co-60



3. Linear accelerator
4. Simulator
5. CT simulator
6. Treatment planning system
7. Fabrication of treatment aids
8. Respiratory gating
9. Portal imaging

B14 Introduction in radiopharmaceuticals (1 hour)

1. Design and production
 - 1.1 Design characteristics of radiopharmaceuticals
 - 1.2 Production of radionuclides
 - 1.3 Radionuclide generators
 - 1.4 Molybdenum-99 / Technetium-99m generator system
 - 1.5 Technetium radiopharmaceuticals
 - 1.6 Other single photon agents
 - 1.7 Radiopharmaceuticals for positron emission tomography
 - 1.8 Mechanism of localization

B15 Radionuclide imaging: SPECT, Digital imaging system, In vivo study (1 hour)

1. Gamma camera
 - 1.1 Components of gamma camera
 - 1.2 Principles of operation
 - 1.3 Digital camera
 - 1.4 Performance parameters of gamma camera
 - 1.5 Quality control of gamma camera
2. Digital imaging system, SPECT, PET, and QC
 - 2.1 Computing terminology and the function of major hardware components of digital computer used in nuclear medicine
 - 2.2 The representation and storage of numbers and images in digital computer



- 2.3 The capabilities and operation of the gamma camera/computer interface (A/D converter)
- 2.4 Digital imaging in NM system
- 2.5 Matrix mode of SPECT
- 2.6 Physical basis of SPECT
- 2.7 SPECT acquisition and reconstruction technique
- 2.8 SPECT filters
- 2.9 SPECT quality assurance
- 2.10 Basic principle of PET and cyclotron
- 2.11 PET instrumentation
- 2.12 Clinical and research application of PET

3. In vivo studies

- 3.1 Tracer principles
- 3.2 Compartment modeling
- 3.3 Static system (tracer dilution principle)
- 3.4 Kinetic systems

B16 Bone density measurement (1 hour)

- 1. Basic principles of bone mineral density (BMD) equipment
- 2. Application of BMD for diagnosis
- 3. Simple circuits
- 4. Photon absorption techniques
- 5. Bone density measurements
- 6. Advantage of DPA over SPA
- 7. Patient Radiation dose
- 8. Dual photon energies
- 9. Comparison between DXA and DPA
- 10. Filtration systems
- 11. Electronic systems and scintillation detectors



12. Display unit

B17 Radiation protection in diagnostic radiology (1 hour)

1. Basic principles of radiation protection
2. Reduction of radiation exposure of the staff: time, distance, shielding
3. Reduction of radiation dose to the patient
4. Effective dose
5. Regulations, equipment regulations
6. Radiation detectors
7. Natural background radiation
8. Proper radiological technique in diagnostic imaging

B18 Radiation protection in Nuclear Medicine (1 hour)

1. Hazards from radioactive unsealed source
2. Maximum permissible body burden, MPBB
3. Maximum permissible concentration, MPC
4. Hot lab design
5. Rules and regulation in the hot lab
6. Hot lab monitoring
7. Storage of radioactive materials
8. Accidents
9. Contamination and decontamination
10. Radioactive waste disposal and control
11. Transportation of radioactive materials

B19 Radiation protection in radiotherapy (1 hour)

1. Treatment in radiation oncology
2. Dose limit for radiation workers and for publics
3. Radiation Protection for teletherapy
 - 3.1 Design and calculation on for barrier thickness against primary radiation, secondary radiation and leakage radiation



3.2 Neutron protection from linear accelerator

4. Radiation hazard and legal aspect of radiation protection

4.1 Storage, preparations transportation of radiation source

4.2 Test for Leakage radiation

4.3 Radiation monitoring

B20 Legal aspect of radiation protection establishments (1 hour)

Radiation hazard and legal aspect of radiation protection

1. Laws and Criteria concerned radiation workers, i.e. atomic energy for peace act, labor protection act for BE 2541
2. Responsibility of the Head of Department
3. Responsibility of the technical officer
4. Radiation application for radiation worker, step for application and the use of standard forms

1.2 Physics of Diagnostic Radiology

D1 Introduction to radiographic technique (1 hour)

1. Parameters related to radiographic image quality (e.g. KV, mAs, FFD, OFD, FOV, Object thickness)

D2 Digital Imaging (1 hour)

1. Basic principle of digital imaging
 - CR
 - DR
 - DSA
 - DSI

D3 Quality assurance in diagnostic X-ray instruments (1 hour)

1. Basic principle of quality control and quality assurance of radiographs and diagnostic x-ray instruments

D4 Mammography (1 hour)

1. Mammography



D5 Advanced computed tomography (1 hour)

1. HRCT
2. CT Fluoroscopy
3. CT Angiography
4. Post processing
5. Quality control for CT

D6 Ultrasound (2 hours)

1. Physical properties of ultrasound
2. Ultrasound transducer
3. Acoustic impedance
4. Axial and lateral resolution
5. Ultrasound instrument
6. Doppler ultrasound
7. Tissue Harmonic
8. Quality assurance and preventive maintenance

D7 Advanced MRI (1 hour)

1. Fast MR pulse sequences
2. MR spectroscopy
3. MR angiography (TOF, PC and CE)
4. Techniques of cardiac MRI
5. Methods in functional brain MRI (Diffusion, Perfusion, BOLD)

D8 PACS (1 hour)

1. Basic Principle in PACS
2. PACS connection
3. DICOM Format
4. Storage

D9 Concepts of image quality (1 hour)

1.3 Physics of Nuclear Medicine (N1-N5)



N1 Radiopharmaceuticals

N2 Radiation detection systems in nuclear medicine

N3 Radionuclide counting statistics

N4 Internal radiation medicine

N5 Radioimmunoassay and related procedures

1.4 Physics of Radiation Therapy (T1 – T7)

T1 Photon beams

T2 Electron and particle beams

T3 Radiation therapy treatment planning

T4 Brachytherapy

T5 Advanced in radiotherapy

T6 Quality assurance/quality control in radiotherapy

T7 image guided radiotherapy



2. RADIOBIOLOGY

A. Basic Molecular Cell Biology (3 hours)

- Basic concepts in molecular cell biology
- Molecular techniques in Radiobiology

B. 1. Basic Radiation Biology (10 hours)

- Molecular aspects of radiobiology
- Action of ionizing radiation on cells
- Molecular response to radiation action

2. Biological basis of radiotherapy

- Proliferation kinetics and normal organ response
- Tumor growth kinetics and tumor organ response
- Analysis of cell survival curve
- Five R's in radiotherapy

C. Health Effects of Ionizing Radiations (5 hours)

- Acute effects of total body irradiation
- Radiation carcinogenesis
- Effects of ionizing radiations on embryo and fetus
- Genetics effects of ionizing radiation
- Radiation cataractogenesis



II. เนื้อหาความรู้ทางรังสีวิทยาของระบบต่างๆ (เพิ่มเติมจากภาคผนวกที่ ๑)

1. NEURORADIOLOGY

NEUROIMAGING

Knowledge

Basic and Advanced Instrumentation

- Must know**
1. Plain films
 2. Computed tomography (CT)
 - Basic techniques
 - Multidetector CT (MDCT)
 - CT dose reduction technique
 - CT angiography (CTA)
 - CT perfusion imaging
 3. Magnetic resonance imaging (MRI)
 - Spin echo
 - Gradient echo
 - Inversion recovery
 - Chemical shift imaging
 - Suppression techniques
 - Fast imaging techniques
 - Diffusion/perfusion imaging
 - MR angiography (MRA)
 - MR spectroscopy
 - Functional MRI
 4. Angiography
 - Catheters
 - Injection rates
 - Projections



- Filming sequences
- Complications

Brain and coverings

A. Normal anatomy

- Must know**
1. Skull, sutures
 2. Major apertures
 3. Hemispheres, cortex, gyri, sulci
 4. Normal myelination
 5. Fissures and cisterns
 6. Basal ganglia, thalamus, hypothalamus, pituitary gland, pineal gland
 7. Brain stem and cerebellum
 8. Ventricles, choroid plexus
 9. Vessels and major branches

B. Congenital CNS lesions

Must know

1. Embryology of brain development
2. Normal variants
3. Disorders of organogenesis

Must know

- Anencephaly
- Cephaloceles
- Chiari malformations (I-IV)
- Corpus callosum anomalies: agenesis, dysgenesis, lipomas
- Hydranencephaly
- Porencephaly

4. Disorders of neuronal migration and sulcation

Must know

- Lissencephaly
- Cortical dysgenesis: agyria-pachygyria, polymicrogyria



- Heterotopia
- Schizencephaly

5. Disorders of diverticulation and cleavage

- Must know**
- Holoprosencephaly (alobar, semilobar, lobar)
 - Septo-optic dysplasia
 - Absent septum pellucidum

6. Posterior fossa cystic disorders

- Must know**
- Dandy-walker complex
 - Mega cisterna magna
 - Arachnoid cyst

7. Disorders of histogenesis (phakomatoses)

- Must know**
- Neurofibromatosis type I and type II
 - Tuberous sclerosis
 - Sturge-Weber syndrome
 - Von Hippel-Lindau syndrome
- Should know**
- Ataxia-telangiectasia (Louis-Bar syndrome)
 - Rendu-Osler syndrome
 - Basal cell nevus syndrome

C. CNS Infections

1. Pyogenic infections

- Must know**
- Meningitis
 - Cerebritis
 - Abscess
 - Subdural and epidural empyema

2. Encephalitis

- Must know**
- Herpes simplex (HSV I & II)
 - Human immunodeficiency virus (HIV)
- Should know**
- Sporadic and epidemic prion disease (Creutzfeldt–Jakob disease)



- Subacute sclerosing panencephalitis (SSPE)

3. Granulomatous infections

Must know

- Tuberculosis
- Fungal infection
- Parasite infection

Should know

- Sarcoidosis

4. Infections in the immunocompromised host and patients with AIDS

Must know

- Toxoplasmosis
- Progressive multifocal leukoencephalopathy (PML)
- Cytomegalovirus infection
- Cryptococcal infection

D. Intracranial tumor

1. Glial tumors (gliomas)

Must know

- Astrocytomas
- Glioblastoma multiforme (GBM)
- Oligodendroglioma
- Ependymoma
- Subependymoma
- Choroid plexus papilloma
- Subependymal giant cell astrocytoma
- Pleomorphic xanthoastrocytoma

2. Neuronal and mixed neuronal-glioma tumors

Must know

- Ganglioglioma
- Gangliocytoma
- Lhermitte-Duclos disease
- Dysembryoplastic neuroepithelial tumors (DNETs)
- Central neurocytoma
- Olfactory neuroblastoma (esthesioneuroblastoma)



3. Meningeal and mesenchymal tumors

- Must know**
- Meningioma
 - Hemangiopericytoma
 - Hemangioblastoma
 - Osteocartilagenous tumors
- Should know**
- Fibrous histiocytoma
 - Malignant mesenchymal tumors

4. Pineal region tumors

- Must know**
- Germinoma
 - Teratoma
 - Pineoblastoma
 - Pineocytoma
 - Primitive neuroectodermal tumors (PNET)
 - Pineal cysts
- Should know**
- Embryonal carcinoma
 - Yolk sac (endodermal sinus) tumors
 - Choriocarcinoma
 - Retinoblastoma

5. Sellar and parasellar tumors

- Must know**
- Pituitary adenoma
 - Craniopharyngioma
 - Rathke's cleft cyst
 - Meningioma
 - Arachnoid cyst
 - Hypothalamic glioma
 - Hamartoma
 - Chordoma
 - Pituitary hypoplasia with ectopic posterior bright spot,



pituitary apoplexy, pituitary abscess

6. Cerebellopontine angle tumor

Must know

- Nerve sheath tumor
- Meningioma
- Epidermoid
- Arachnoid cyst
- Metastasis

7. Intraventricular tumors

Must know

- Choroid plexus papilloma
- Choroid plexus carcinoma
- Colloid cyst
- Giant cell astrocytoma
- Central neurocytoma

8. Infratentorial tumors

Must know

- Medulloblastoma
- Ependymoma
- Brainstem glioma
- Juvenile pilocytic astrocytoma
- Hemangioblastoma

9. Hemopoietic neoplasms

Must know

- Lymphoma
- Leukemia
- Multiple myeloma and its variant

Must know 10. Metastatic tumors

E. Neoplasm of scalp or skull

Must know

- Osteoma
- Fibrous dysplasia
- Hemangioma



- Chondrosarcoma
- Osteosarcoma
- Chordoma
- Metastasis
- Histiocytosis

F. Trauma

Must know

1. Primary lesions

- Skull fracture, scalp hematoma/laceration
- Extracerebral hemorrhage
- Epidural hematoma
- Subdural hematoma
- Subarachnoid hemorrhage
- Intracerebral lesions
- Cortical contusion
- Intraventricular hemorrhage
- Brainstem injury
- Deep cerebral gray matter injury
- Diffuse axonal injury

Must know

2. Secondary lesions

- Cerebral herniations
- Traumatic ischemia, infarction
- Diffuse cerebral edema
- Hypoxic injury

Must know

3. Vascular injuries

- Dissection
- Pseudoaneurysm
- Carotid-cavernous fistula

G. White matter diseases



- Must know**
1. Multiple sclerosis
 2. Acute disseminated encephalomyelitis (ADEM)
 3. Small vessel ischemic disease, hypertension
 4. White matter change in elderly
 5. Radiation/chemotherapy changes
 6. Osmotic myelinolysis
- Should know**
7. Dysmyelinating disorders
 - Adrenoleukodystrophy
 - Krabbe's
 - Metachromatic leukodystrophy (MLD)
 - Alexander
 - Canavan's
 8. Neurodegenerative disorders
 - Alzheimer disease and other cortical dementias
 - Extraparamidal disorders and subcortical dementias
 - Parkinson disease
 - Cerebellar degenerations

H. Cerebrovascular disease

1. Ischemic and infarction

- Must know**
- Strategies for imaging
- Must know**
- Etiology
 - Occlusions large/small vessel
 - Embolic
 - Watershed (hypoperfusion)
 - Hypoxia/anoxia
 - Dissection
 - Fibromuscular dysplasia (FMD)
 - Vasculitis



- Venous thrombosis

- Vasospasm

2. Non-traumatic intracranial hemorrhage

Must know

- Etiologies
- Aneurysm
- Arteriovenous malformation
- Tumor
- Hematologic causes
- Drugs
- Infarction
- Amyloid angiopathy
- Hypertension

3. Aneurysms

Must know

- Types
 - Berry aneurysm
 - Giant aneurysm
 - Fusiform aneurysm
 - Dissecting aneurysm
 - Mycotic aneurysm
- Must know** - Complication: rupture, mass effect, hydrocephalus, spasm

4. Cerebrovascular malformations

Must know

- Capillary telangiectasia
- Cavernous malformation
- Developmental venous anomaly (DVA)
- Arteriovenous malformations (AVMs): brain and dural
- Vein of Galen aneurysmal malformation

I. Metabolic, endocrine, toxic and systemic disorders

Should know

- Hypoglycemia



- Alcoholic encephalopathy
- Hepatic encephalopathy
- Acute hypertensive encephalopathy
- Chronic hypertensive encephalopathy
- Idiopathic intracranial hypertension
- Carbon monoxide poisoning
- Osmotic demyelination syndrome
- Radiation and chemotherapy
- Mesial temporal sclerosis
- Status epilepticus

Should know

- Kernicterus
- Drug abuse
- Hypothyroidism
- Fahr disease

J. Hydrocephalus

Must know

- Intraventricular obstructive hydrocephalus
- Extraventricular obstructive hydrocephalus
- Aqueductal stenosis
- Normal pressure hydrocephalus
- CSF shunts and complication

K. Cognitive imaging

Should know Role of advanced imaging in

- Epilepsy
- Dementia
- Psychogenic disorders



ANGIOGRAPHY AND INTERVENTIONAL NEURORADIOLOGY

- Must know**
1. Technique of basic catheterization incerebral angiogram
 2. Indications: elective and emergency
 3. Risks, complications and management
 4. Iodine contrast media: types and pharmacological properties, contrast reaction and management
 5. Interpretations of basic neuro- vascular diseases
 - Aneurysms (rupture/nonrupture, berry/pseudoaneurysm, giant)
 - Arteriovenous malformation (AVM)
 - Dural AV shunts / arteriovenous fistula (AVF)
 - Stenosis/occlusion (atheroscleortic, thromboembolic, spontaneous dissection, arteritis, Moya Moya, Takayasu, FMD)
 - Trauma (dissection, pseudoaneurysm, AVF, carotid-cavernous fistula)
 - Common vascular neoplasms (meningioma, juvenile angiofibromas, paragangliomas, hemangioblastomas)
 - Venous or dural sinus thrombosis
 - Spinal vascular diseases (including normal spinal angiogram)
 - Variations and collateral anastomosis
 6. Indications, risks and benefits of neurointerventional procedures including embolization, angioplasty and stenting



HEAD AND NECK IMAGING

A. Paranasal sinuses and Nasal cavity

- Must know**
1. Anatomy
 2. Congenital disease
- Must know**
- Encephalocele
- Should know**
- Dermal sinus tract
 - Choanal atresia
 - Dacrocystocele
3. Inflammatory diseases
- Must know**
- Sinusitis and its complication
 - Acute sinusitis
 - Polyposis
 - Mucocele
4. Benign sinus tumors
- Must know**
- Osteoma
 - Antrochoanal polyp
 - Juvenile angiofibroma
 - Inverted papilloma
- Must know**
5. Malignant sinus tumors

B. Orbit and visual pathways

1. Anatomy
- Must know**
- Ocular structures
 - Bony orbit
 - Extraocular muscles
 - Optic nerve sheath complex
 - Visual pathway
2. Intra-ocular lesions
- Must know**
- Retinoblastoma



- Melanoma
- Retinal detachment
- Metastases
- Infection and inflammation
- Drusen
- Phthisis bulbi
- Should know**
 - Retrolental fibroplasias
 - Coat' disease
 - Primary hypertrophic persistent vitreous (PHPV)
- 3. Intraconal lesions
- Must know**
 - Optic nerve glioma
 - Optic nerve meningioma
 - Lymphoma
 - Pseudotumor
 - Graves' disease
 - Vascular anomaly
 - Neurofibroma/schwannoma
 - Infection
 - Metastasis
- 4. Extraconal lesions
- Must know**
 - Infection and inflammation:
 - Metastasis
 - Rhabdomyosarcma
 - Vascular anomaly
 - Lymphoma/leukemia/myeloma
- 5. Trauma
- Must know**
 - Fracture of orbital walls
 - Extraocular muscle entrapment



- Injury of the globe and optic nerve

C. Skull base

Must know

1. Anatomy
2. Nonneoplastic disorders

Must know

- Cephaloceles
- Dysplasias
- Inflammation / infection and obstruction of sphenoid sinus

Should know

- Variation of sphenoid bone
- Vascular variants

3. Tumors and tumorlike conditions

Must know

- Fibrous dysplasia
- Chordomas
- Chondroid tumor
- Meningiomas
- Craniopharyngomas and Rathke's cleft cysts
- Juvenile angiofibromas
- Pituitary adenomas
- Neurogenic tumors
- Mucoceles
- Aneurysms

Should know

- Giant cell lesions
- Aneurysmal bone cysts

Must know

4. Secondary tumor involvement of the skull base
 - Direct encroachment
 - Perineural spread
 - Hematogenous metastasis

Must know

5. Trauma

Must know

6. Cerebrospinal fluid leak



D. Temporal bone

Must know

1. Anatomy
2. Congenital anomalies
 - Anomalies of external ear
 - Anomalies of middle ear
 - Anomalies of inner ear
 - Vascular anomalies: internal carotid artery and high jugular bulb
3. Inflammatory disease

Must know

- Otitis media, mastoiditis and complications
- Cholesteatoma
- Malignant otitis externa
- Petrous apex: petrositis, mucocele, cholesterolgranuloma

Should know

- Labyrinthitis
- Labyrinthitis ossificans
- Postoperative temporal bone
- Autoimmune inner ear disease

4. Trauma

Must know

- Fractures and ossicular dislocation
- Dysequilibrium and Facial nerve dysfunction

Should know

5. Otosclerosis

Must know

6. Pulsatile tinnitus

- Paraganglioma
- Dural AVMs
- Arteriovenous fistula or AVM of head and neck
- Aberrant internal carotid artery
- High riding/dehiscent jugular vein

E. Oral cavity

1. Anatomy



- Must know**
- Tongue
 - Floor of mouth
 - Sublingual space
 - Submandibular space

2. Benign lesions

- Must know**
- Pleomorphic adenoma
 - Nerve sheath tumor
 - Fibroosseous diseases
 - Lipoma
 - Exostoses
- Should know**
- Aggressive fibromatosis
 - Rhabdomyoma
 - Miscellaneous benign lesions

3. Malignant lesions

- Must know**
- Squamous cell carcinoma
 - Lymphoma
 - Adenoid cystic carcinoma
- Should know**
- Mucoepidermoid carcinoma
 - Liposarcoma
 - Rhabdomyosarcoma

4. Infection and inflammation

- Must know**
- Abscess, cellulitis, sialolith
 - Ludwig's angina
 - Ranula

5. Vascular malformations

- Must know**
- AVM/ capillary malformation/venous malformation
 - Lymphatic malformation

F. Neck



- Must know** 1. Fascias and spaces of the neck
- Pharyngeal mucosal space
 - Parapharyngeal space
 - Masticator space
 - Parotid space
 - Posterior cervical space
 - Prevertebral space
 - Visceral space
- Must know** 2. The spaces of the neck as a basis for differential diagnosis
- Must know** 3. Pharyngeal mucosal space
- Congenital Lesions
 - Tornwaldt cyst
 - Infectious and Inflammatory Lesions
 - Retention cyst of pharyngeal mucosal space
 - Tonsillar inflammation
 - Tonsillar / Peritonsillar abscess
 - Benign and malignant tumors
 - Benign mixed tumor of pharyngeal mucosal space
 - Minor salivary gland malignancy of pharyngeal mucosal space
 - Non-Hodgkin lymphoma of pharyngeal mucosal space
- Must know** 4. Parapharyngeal space
- Prestyloid compartment (as an important landmark)
 - Post styloid compartment or carotid space
- Must know** 5. Carotid space
- Normal variants
 - Tortuous carotid artery in neck
 - Vascular lesions
 - Carotid artery pseudoaneurysm



- Fibromuscular dysplasia
- Acute idiopathic carotidynia
- Jugular vein thrombosis
- Post-pharyngitis venous thrombosis (Lemierre)

- Benign tumors
 - Paraganglioma
 - Nerve sheath tumor
 - Meningioma

Must know 6. Masticator Space

- Pseudolesions
 - Pterygoid venous plexus asymmetry
 - Benign masticator muscle hypertrophy
 - CNV3 motor denervation
- Infectious Lesions
 - Masticator space abscess
- Benign tumors
 - CNV3 schwannoma
- Malignant tumors
 - CNV3 perineural tumor
 - Chondrosarcoma
 - Sarcoma

Must know 7. Parotid space

- Infectious and inflammatory lesions
 - Acute parotitis
 - Parotid Sjogren syndrome
- Benign lymphoepithelial lesions-HIV
 - Benign Tumors
 - Benign mixed tumor



- Warthin tumor
- Schwannoma
- Malignant tumors
 - Mucoepidermoid carcinoma
 - Adenoid cystic carcinoma
 - Malignant mixed tumor
 - Non-Hodgkin lymphoma
 - Metastatic disease of parotid nodes

Must know 8. Retropharyngeal space

- Infectious and inflammatory lesions
 - Reactive adenopathy
 - Suppurative adenopathy
 - Abscess
 - Edema
- Metastatic tumors
 - Nodal SCCa
 - Nodal non-Hodgkin lymphoma
 - Non-SCCa metastatic nodes

Must know 9. Perivertebral space

- Pseudolesion
 - Levator scapulae muscle hypertrophy
- Infectious and inflammatory lesions
 - Acute calcific longus colli tendonitis
 - Infection
- Vascular lesions
 - Vertebral artery dissection
- Benign and malignant tumors
 - Brachial plexus schwannoma



- Chordoma
- Vertebral body metastasis

Must know 10. Posterior cervical space

- Benign tumors
 - Schwannoma
- Metastatic tumors
 - SCCa in spinal accessory node
 - Non-Hodgkin lymphoma in spinal accessory node

Must know 11. Visceral space

- Inflammatory lesions
 - Chronic lymphocytic thyroiditis (Hashimoto)
- Metabolic disease
 - Multinodular goiter
- Benign tumors
 - Thyroid adenoma
 - Parathyroid adenoma in visceral space
- Malignant tumors
 - Differentiated thyroid carcinoma
 - Medullary thyroid carcinoma
 - Anaplastic thyroid carcinoma
 - Non-Hodgkin lymphoma
 - Parathyroid carcinoma
 - Cervical esophageal carcinoma

12. Hypopharynx, larynx, and cervical trachea

- Must know**
- Infectious and inflammatory lesions
 - Croup
 - Epiglottitis in a child
 - Supraglottitis



- Trauma
 - Laryngeal trauma
- Should know**
 - Benign and malignant tumors
 - Upper airway infantile hemangioma
 - Laryngeal chondrosarcoma
- Should know**
 - Treatment – related lesions
 - Post – radiation larynx
- Must know**
 - Miscellaneous
 - Laryngocele
 - Vocal cord paralysis
 - Acquired subglottic -Tracheal stenosis

13. Lymph nodes

- Must know**
 - Nodal classification: the level system
 - Lymphadenitis and etiology
 - Criteria for assessing metastatic nodes

Must know 14. Squamous all carcinoma: primary site, perineural tumor spreading and nodes

Must know 15. Post -treatment neck

G. Jaw and dental pathology

- Must know**
 1. Odontogenic cyst
 2. Ameloblastoma
 3. Fibroosseous lesion
 4. Inflammation and infection
 5. Vascular malformations
- Should know**
 6. Nonodontogenic cyst: bone cyst
 7. Nonodontogenic tumors

Spine and spinal cord

A. Anatomy and biomechanics



- Must know**
- Vertebral column
 - Facet joints and transverse processes
 - Lamina and spinous processes
 - Support ligaments
 - Specific characteristics of cervical, thoracic and lumbar segments
 - Craniovertebral junction
 - Spinal cord anatomy
 - Vascular and functional anatomy of spinal cord
 - Normal stability and motion

B. Developmental spine disease

1. Developmental abnormalities

- Must know**
- Myelocele, myelomeningocele
 - Chiari II malformation
 - Spinal lipomas, lipomyelocele, lipomyelomeningocele
 - Tight filum
 - Sacroccygeal teratoma
 - Split notochord syndrome, diastamatomyelia
 - Meningocele, terminal meningocele, Tarlov cyst

- Should know**
- Dorsal dermal sinus
 - Fibrolipomas of the filum terminale
 - Caudal regression
 - Myelocystocele, terminal myelocystocele

Must know 2. Congenital tumors: teratomas, dermoid, epidermoid, hamartoma

Must know 3. Syringohydromyelia

Should know 4. Craniovertebral anomalies: osodontoideum, assimilation of atlas

Should know 5. Dysplasia: achondroplasia, osteogenesis imperfecta

Must know 6. Neurocutaneous syndromes



C. Inflammatory / infection and demyelinating disease

- Must know**
1. Osteomyelitis
 2. Discitis
 3. Epidural and paravertebral abscess
 4. Tuberculous infection
 5. Meningitis/arachnoiditis
 6. Spinal cord lesions: abscess, granuloma, transverse myelitis, multiple sclerosis, ADEM

D. Neoplastic disease

1. Neoplasm of vertebra
- Must know**
- Primary benign bone tumors:
 - Intradural extramedullary lesions: meningioma, schwannoma, neurofibroma, lipoma, dermoid, epidermoid, epidermal inclusion cyst, metastases, carcinomatous meningitis, lymphoma,
 - Intramedullary lesions: ependymoma, astrocytoma, hemangioblastoma, lymphoma, metastases

E. Trauma

- Must know**
1. Biomechanic of injury: flexion, extension, axial loading, compression, distraction, rotation

2. Fractures and dislocation
- Must know**
- Stable fractures: compression fracture, isolated anterior column, isolated posterior column, unilateral locked facet, clay shoveler's
 - Unstable fractures: hyperextension teardrop, Hyperflexion teardrop, hyperflexion teardrop, hyperflexion ligamentous injury. bilateral locked facet, odontoid fracture, Hangman's fracture, chance, burst
- Must know**
3. Traumatic disc herniation
 4. Spinal cord contusion



5. Intraspinial hemorrhage

- Epidural hematoma
- Subdural hematoma

Must know 6. Post-traumatic abnormalities: syringomyelia, arachnoiditis, pseudomeningocele and root avulsion instability with spondylolisthesis

Must know 7. Postoperative findings:

- Common spinal procedures and instrumentation
- Normal post-therapeutic appearance
- Failed back syndrome
- Complications of myelography, vertebroplasty, intervention, surgery

F. Degenerative disease

Must know 1. Disc degeneration/ herniation / posterior element

2. Spinal stenosis

3. Arthritis

G. Vascular lesions

Must know 1. Spinal cord AVM

2. Spinal dural AVF

3. Cavernoma

4. Spinal cord ischemia and infarction

Should know 5. Paraspinal AVM



BODY INTERVENTIONAL RADIOLOGY

Knowledge

1. Principles, indications and contraindications of the followings

1.1 Vascular imagings:

- Must know**
- 1.1.1 Angiography
 - 1.1.2 CTA
 - 1.1.3 MRA

1.2 Vascular intervention

- Must know**
- 1.2.1 Transarterial embolization
- Should know**
- 1.2.2 Angioplasty, venoplasty
 - 1.2.3 Thrombolysis
 - 1.2.4 Transarterial infusion
 - 1.2.5 Transvenous occlusion
 - 1.2.6 Transjugular intrahepatic portosystemic stent (TIPS)
 - 1.2.7 IVC filter placement
 - 1.2.8 Tunnel/ non-tunnel venous catheter placement
 - 1.2.9 Retrieval of foreign body
 - 1.2.10 Aortic stent graft
 - 1.2.11 Hemodialysis access interventions

1.3 Non-vascular intervention

- Must know**
- 1.3.1 Abscess and collection drainage
 - 1.3.2 Percutaneous transhepatic biliary drainage (PTBD)
 - 1.3.3 Percutaneous biopsy and drainage under imaging guidance
- Should know**
- 1.3.4 Percutaneous nephrostomy (PCN)
 - 1.3.5 Percutaneous cholecystostomy
 - 1.3.6 Percutaneous injection therapy, eg. Liver, tumor, cyst ablation
 - 1.3.7 Tumor ablation
 - 1.3.8 Removal of foreign body



1.3.9 Dilatation of biliary stricture/ cholangioplasty

1.3.10 Biliary stent placement

Should know 2. Imaging technique, patient preparation and patient care

Should know 3. Catheters, guide wires, needles and equipment

Should know 4. Embolic materials



EMERGENCY RADIOLOGY

Skills (Techniques and Interpretation, also combined with other systems)

Knowledge

1. Clinical prediction rules for emergency imaging

Must know

- New Orleans Criteria and Canadian CT Head Rule
- Canadian C-spine Rule and NEXUS criteria
- PLOPED criteria and Well's criteria

2. Appropriateness of imaging in acute conditions

Must know

- Appropriateness criteria for acute traumatic conditions
- Head, spine, chest (including rib and aorta), abdominal (including renal and lower urinary tract), extremity trauma, penetrating neck injury, pediatric head trauma and suspected physical abuse
- Appropriateness criteria for acute non-traumatic conditions
- Cardiovascular: acute chest pain (suspected aortic dissection, non-specific chest pain, acute coronary syndrome), dyspnea (suspected cardiac origin), suspected pulmonary embolism, suspected abdominal aortic aneurysm, sudden cold painful leg, suspected DVT
- GI: right upper quadrant pain, right lower quadrant pain, left lower quadrant pain, suspected small bowel obstruction, acute pancreatitis, suspected abdominal abscess, mesenteric ischemia, upper GI bleeding
- GU: acute flank pain, acute scrotal pain, acute pyelonephritis, acute pelvic pain, abnormal vaginal bleeding, vaginal bleeding in pregnancy (1st, 2nd & 3rd trimesters)
- MSK: suspected osteomyelitis, septic arthritis, and soft tissue infection
- CNS: cerebrovascular disease, focal neurologic deficit, headache, seizures
- Pediatrics: headache, seizures
- Thoracic: acute respiratory illness, hemoptysis



3. Imaging techniques, patient preparation and patient care

- Must know**
- Conventional radiograph
 - CT (conventional CT, CT angiography, and CT venography)
 - Ultrasound
 - MRI (acute stroke and spinal cord compression)
- Should know**
- CT perfusion, CT cystography
 - MRI, MR angiography and venography (for indications other than above)

4. Trauma imaging in Advanced Trauma Life Support (ATLS)

- Must know**
- Concepts of trauma imaging
 - Portable radiograph
 - Focused Assessment with Sonography for Trauma (FAST) and Extended Focused Assessment with Sonography for Trauma (EFAST)
 - CT

5. Traumatic and non-traumatic conditions

5.1 Central nervous system

- Must know**
- Trauma of brain, skull, orbit, facial structures and aerodigestive tract
 - Herniation syndromes
 - Non-traumatic hemorrhage
 - Cerebral infarction
 - Non-traumatic neurovascular conditions e.g. posterior reversible encephalopathy syndrome (PRES), dural sinus thrombosis
 - CNS infections
 - Infections of paranasal sinuses, neck, ear and orbits
- Should know**
- Penetrating injuries
 - Traumatic neurovascular conditions
 - Pituitary apoplexy

5.2 Spine

- Must know**
- Trauma of cervical, thoracic, lumbosacral spine



- Osteomyelitis/discitis
 - Epidural abscess
 - Disk herniation
 - Should know**
 - Acute myelopathy
- 5.3 Chest**
- Must know**
 - Chest trauma
 - Acute pulmonary infections
 - Aspiration pneumonia
 - Airway foreign bodies
 - Obstructive airway disease
 - Esophageal rupture
 - Pulmonary embolism and thromboembolic disease
 - Should know**
 - ARDS: near-drowning, fat embolism syndrome

5.4 Cardiovascular

- Must know**
 - Cardiac trauma and tamponade
 - Aortic and vascular trauma
 - Acute aortic syndrome
 - Acute arterial occlusion
 - Pulmonary edema
- Should know**
 - Volume assessment with IVC ultrasound

5.5 Abdomen

- Must know**
 - Abdominal trauma
 - Ascites, peritonitis, abdominal abscesses
 - Hepatobiliary infection and jaundice
 - Pancreatitis
 - Urinary tract infection and stone disease
 - Bowel obstruction, hemorrhage, infarction and infection
 - Inflammatory bowel disease



5.6 Genitourinary

Must know

- Ovarian torsion
- Pelvic inflammatory disease
- Pregnancy complications, e.g. ectopic pregnancy, spontaneous abortion, subchorionic hemorrhage
- Testicular torsion and infection
- Scrotal and testicular trauma
- Urethral and penile trauma

5.7 Extremities

Must know

- Fractures and dislocations of upper and lower extremities
- Pelvic and acetabular fractures
- Insufficiency and stress fractures
- Avascular necrosis
- Septic arthritis

5.8 Pediatrics

Must know

- Accidental and non-accidental trauma
- Head, neck, and spine infection
- Respiratory tract infection, foreign body aspiration, respiratory distress
- Intraabdominal infection/inflammation, hemorrhage, bowel obstruction
- Musculoskeletal infection

6. Diagnosis and treatment of acute contrast reaction and extravasation

Must know

- Recognition of adverse reactions to contrast media (iodinated and gadolinium-based) e.g. hypersensitivity and chemotoxic reactions
- Risk factors for adverse reactions
- Evaluating the patient before and after contrast medium administration
- Treatment of adverse reactions
- Treatment of contrast extravasation



NUCLEAR MEDICINE

เนื้อหาวิชา

A. BASIC SCIENCES

1. **Basic physics** เช่นเดียวกับ medical radiation physics and radiobiology

B. CLINICAL STUDIES

1. Radionuclide imaging studies

1.1 Central nervous system

Must know - Brain SPECT

Should know - CSF scan

1.2 Musculoskeletal system

Must know - Bone scan

1.3 Cardiovascular system

Must know - Myocardial perfusion scan

- MUGA scan

1.4 Pulmonary system

Must know - Ventilation-perfusion lung scan

1.5 Gastrointestinal and hepatobiliary system

Must know - Hepatobiliary system

- G.I. bleeding

Should know - Liver RBC scan

1.6 Genitourinary system

Must know - Renal scan

Should know - VUR

1.7 Endocrine system

Must know - Thyroid and total body scan

- Parathyroid scan

- Neuroendocrine scan

1.8 Lymphatic system



Should know - Lymphoscintigraphy

1.9 Oncology

Must know - FDG PET/CT

Should know - Non-FDG PET/CT

2. BONE MINERAL DENSITOMETRY (Must know)

3. RADIONUCLIDE THERAPY

Should know 3.1 Hyperthyroidism

3.2 Thyroid cancer

3.3 Others e.g. bone pain, NET treatment, etc.



RADIATION ONCOLOGY

เนื้อหาวิชา

A. Basic science

1. Medical radiation physics and radiobiology

B. Clinical radiation oncology

1. Principle of radiation therapy

- 1.1 Tumor and tissue radiosensitivity
- 1.2 Factors affecting radiosensitivity
- 1.3 Aim of treatment
- 1.4 Indication of treatment
- 1.5 Result of treatment
- 1.6 Critical organs and organ tolerance dose
- 1.7 Radiation complications
- 1.8 Factors affecting radiation complications
- 1.9 Management of radiation complications

2. **Common cancers** – etiology, epidemiology, natural history, pathology, pretreatment/diagnostic evaluation, staging, prognostic factors, treatment modalities, result of treatment and treatment complications

3. Radiation therapy in common cancers

- 3.1 Breast cancer
- 3.2 Cervical cancer
- 3.3 Lung cancer
- 3.4 Hepatobiliary cancer
- 3.5 Head and neck cancer
- 3.6 CNS tumor
- 3.7 Colorectal cancer
- 3.8 Prostate cancer
- 3.9 Esophageal cancer



3.10 Gastric cancer

3.11 Emergency in radiation therapy

3.12 Radiation therapy in benign disease

4. Radiation equipment

4.1 Teletherapy (External beam radiation therapy)

4.1.1 Megavoltage machines

- Cobalt-60 unit

- Linear accelerator: photon and electron beam

4.2 Brachytherapy

4.2.1 Low-dose rate brachytherapy

4.2.2 Medium-dose rate brachytherapy

4.2.3 High-dose rate brachytherapy

4.3 Simulation machines

4.3.1 Conventional simulation

4.3.2 CT simulation

4.3.3 MRI simulation

4.4 Accessories

4.4.1 Wedge

4.4.2 Bolus

5. Radiation treatment techniques

5.1 Simulation

5.2 Radiation treatment planning

5.2.1 Target volume delineation

5.2.2 Normal tissue contouring

5.2.3 Radiation techniques

5.2.3.1 2D radiotherapy

5.2.3.2 3D radiotherapy

5.2.3.3 Intensity modulated radiation therapy (IMRT)



5.2.3.4 Volumetric arc radiation therapy (VMAT)

5.2.3.5 Stereotactic radiosurgery

5.2.3.6 Stereotactic radiotherapy

5.2.3.7 Intraoperative radiotherapy

5.2.4 Radiation beam parameter

5.2.5 Radiation dose and fractionation

5.3 Radiation treatment verification

5.4 Radiation treatment delivery



III. ความรู้ด้านบูรณาการทั่วไป

เนื้อหาวิชาเป็นความรู้ที่บูรณาการศาสตร์ต่างๆที่เกี่ยวข้องกับการประกอบวิชาชีพเวชกรรม และการบริการทางการแพทย์ด้านรังสีวิทยา ตลอดจนความรู้ด้านมนุษยศาสตร์และสังคมศาสตร์ที่เสริมสร้างปัญญา เจตคติและความเข้าใจต่อเพื่อนมนุษย์และสังคม ยกตัวอย่างเนื้อหาวิชา ดังนี้

๑. ความรู้ด้านกฎหมายที่เกี่ยวข้องกับการประกอบวิชาชีพเวชกรรม

- ๑.๑ หลักกฎหมายทั่วไป ประมวลกฎหมายอาญา ประมวลกฎหมายแพ่งและพาณิชย์ ประมวลกฎหมายวิธีพิจารณาความอาญา ประมวลกฎหมายวิธีพิจารณาความแพ่ง
- ๑.๒ พระราชบัญญัติวิชาชีพเวชกรรม พ.ศ. ๒๕๒๕
- ๑.๓ พระราชบัญญัติสุขภาพแห่งชาติ พ.ศ. ๒๕๕๐ ฉบับที่ ๒ พ.ศ. ๒๕๕๓
- ๑.๔ พระราชบัญญัติหลักประกันสุขภาพแห่งชาติ พ.ศ. ๒๕๔๕
- ๑.๕ พระราชบัญญัติคุ้มครองผู้บริโภค พ.ศ. ๒๕๒๒ ฉบับที่ ๒ แก้ไขเพิ่มเติม พ.ศ. ๒๕๔๑
- ๑.๖ พระราชบัญญัติวิธีพิจารณาคดีผู้บริโภค พ.ศ. ๒๕๕๑
- ๑.๗ พระราชบัญญัติเครื่องมือแพทย์ พ.ศ. ๒๕๕๑
- ๑.๘ พระราชบัญญัติสถานพยาบาล พ.ศ. ๒๕๔๑ ฉบับที่ ๒ พ.ศ. ๒๕๔๓
- ๑.๙ ข้อบังคับและประกาศของแพทยสภา
- ๑.๑๐ คำประกาศสิทธิของผู้ป่วย สิทธิเด็ก สิทธิของผู้พิการและทุพพลภาพ และสิทธิมนุษยชน

๒. ความรู้ด้านเวชสารสนเทศและกฎหมายที่เกี่ยวข้อง

- ๒.๑ ความรู้พื้นฐานด้านเวชสารสนเทศที่เกี่ยวข้องกับรังสีวิทยา
- ๒.๒ กฎหมายด้านเวชสารสนเทศ
 - ๒.๒.๑ พระราชบัญญัติว่าด้วยธุรกรรมทางอิเล็กทรอนิกส์ พ.ศ. ๒๕๔๔
 - ๒.๒.๒ พระราชบัญญัติว่าด้วยการกระทำความผิดเกี่ยวกับคอมพิวเตอร์ พ.ศ. ๒๕๕๐

๓. ความรู้ด้านความปลอดภัยของผู้ป่วย

เนื้อหาหลักสูตรอ้างอิงจาก WHO patient safety curriculum guide

๔. ความรู้ด้านการจัดการด้านคุณภาพ

- ๔.๑ Hospital accreditation
- ๔.๒ JCI



หลักสูตรการฝึกอบรมแพทย์ประจำบ้าน สาขารังสีวิทยาวินิจฉัย จุฬาลงกรณ์มหาวิทยาลัย ภาคผนวกที่ ๒

๕. ความรู้ด้านการจัดการความเสี่ยงเมื่อเกิดปัญหาทางการแพทย์

๕.๑ Risk management

๖. ความรู้ด้านมาตรฐานรหัสทางการแพทย์ที่เกี่ยวข้องกับรังสีวิทยา

๖.๑ ICD 10-TM

๗. ความรู้ด้านมาตรฐานสากลที่เกี่ยวข้องกับรังสีวิทยา

๗.๑ DICOM

๗.๒ PACS

๗.๓ HL7