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Study Plan

Subject Medical Radiation Physics

Topic **B1** Basic Nuclear Physics (2 hr)

Instructor Pachee Chaudakshetrin
อาจารย์ พจี เจาฑะเกษตริน

Learning objectives : At the end of the session, the student should be able to

1. Describe the relationship between mass and energy
2. Explain the characteristic of the atom, atomic structure, nucleus, nuclide, radionuclide, isotope and radioisotope
3. Discuss the principle of radiation and the difference between x-ray and gamma ray
4. Describe the radioactive decay and the relevant mathematics

Learning contents :

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

Method:

1. Lecture

Media:

1. Computer and LCD projector
2. Handout

Evaluation:

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B2** Interaction of radiation with matter

Instructor Puangpen Tangboonduangjit
อาจารย์ ดร.พวงเพ็ญ ตั้งบุญดวงจิต

Learning objectives : At the end of the session, the student should be able to

1. Describe the effect of the interaction of photon with matter
2. Describe the photoelectric effect
3. Describe the Compton effect
4. Describe the pair production
5. Explain the probability of photon interactions in the term of cross section
6. Describe the factors involved photon interaction
7. Describe the important of interaction in diagnostic radiology, radiation therapy and nuclear medicine
8. Explain the interaction of charged particle with matter
9. Describe the parameters involved in the loss of particle energy.

Learning contents :

Interaction of radiation with matter

1. Photon interactions
    a. Photoelectric interaction
    b. Compton interaction
    c. Pair production
2. Probability of interactions
    a. Cross section
    b. Factor involved interaction
3. The importance of each interaction in radiology
    a. Diagnostic radiology
    b. Radiotherapy
    c. Nuclear Medicine
4. Interaction of charged particle with matter
5. Parameters involved the loss of particle energy

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B3** Radiation Quantities and Units

Instructor Assistant Professor Chirapha Tannanonta
ผู้ช่วยศาสตราจารย์จีระภา ตันนานนท์

Learning objectives : At the end of the session, the student should be able to

1. Describe the SI units, special units and special names in radiology
2. Describe the process of ionization
3. Describe the definition of ionizing radiations
4. Describe the definitions of the nuclide and energy deposition event
5. Describe the terms and units used in the measurement of radiation
6. Describe the quantities of dose used in radiation protection
7. Describe the radioactivity and exposure rate constant

Learning contents:

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

Methods:

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation ;

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B4** Production of X-rays

Instructor Associate Professor Dr.Anchali Krisanachinda

รองศาสตราจารย์ ดร.อัญชลี กฤษณจินดา

Learning objectives : At the end of the session, the student should be able to

1. Describe the production of Bremsstrahlung x-rays
2. Describe the production of characteristic x-rays
3. Identify the information contain ed in an x-ray spectrum
4. Identify the changes in x-ray beam quality and quantity resulting from changes kVp,mA, filtration,x-ray circuit waveform and anode material

Learning contents :

X-ray production

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

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B5** Quality of X rays

Instructor Assistant Professor Chirapha Tannanonta

ผู้ช่วยศาสตราจารย์จีระภา ตันนานนท์

Learning objectives : At the end of the session, the student should be able to

1. Describe the definition of quality of x rays
2. Describe the half value layer
3. Describe how to specify the quality of x rays used in diagnostic and therapeutic radiology
4. Describe the effect of filters on the x-ray beams
5. Describe the exponential attenuation
6. Determine the equivalent photon energy of an x-ray beam
7. Calculate the wavelength of an x-ray beam
8. Describe the properties of soft and hard x rays

Learning contents:

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

Method

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study plan

Subject Medical Radiation Physics

Topic **B6** Radiation dosimetry

Instructor อาจารย์ ดร.พวงเพ็ญ ตั้งบุญดวงจิต

Learning Objective At the end of session the student should be able to

1. Describe the process of ionization measurement
2. Explain the characteristic of Free air chamber , cavity ionization chamber
3. Explain the process of Calorimetry, Chemical dosimetry, Radiographic dosimetry, Thermoluminescence dosimetry, Scintillation dosimetry, Semiconductor dosimetry

Learning. Content

1. Ionization chamber
2. Calorimetry
3. Chemical dosimetry
4. Radiographic dosimetry (Film)
5. Thermoluminescence Dosimetry
6. Scintillation Dosimetry
7. Semiconductor Detector

Method :

1. Lecture

Media :

1. PowerPoint Presentation
2. Computer –aided Instruction

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B7** Basic knowledge of medical computer & applications

Instructor Dr.Thanongchai Siriapisith
นายแพทย์ทนงชัย สิริอภิสิทธิ์

Learning objectives : At the end of the session, the student should be able to

1. Identify the information Digital images
2. Identify the information contained the Computer Assisted Diagnosis (CAD)
3. Describe the procedures of basic PACS and Teleradiology

Learning contents :

1. Development of Digital imaging
2. Type of Digital imaging
3. Image characteristics
4. Computer Assisted Diagnosis (CAD)
5. Basic Picture Archive Communication System
6. Basic principles of Teleradiology

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B8** Diagnostic x-ray equipment

Instructor Associate Professor Dr.Anchali Krisanachinda

รองศาสตราจารย์ ดร.อัญชลี กฤษณจินดา

Learning objectives : At the end of the session, the student should be able to

1. Identify the difference between alternating and direct current
2. Identify single phase, three phase and high frequency waveforms
3. Describe the relationship between current and voltage in the primary and secondary sides of step-up and step-down transformers.
4. Identify the components of a typical x-ray circuit and their purpose.
5. Define voltage ripple
6. Describe the components of a typical x-ray tube and their purpose
7. Describe the line focus and heel effect
8. Define anode heat unit
9. Recognize allowed and forbidden tube heat loads

Learning contents :

1. Direct and alternating current
2. Single phase and three phase circuit
3. High voltage circuit
4. Control panel components
5. Backup timer
6. High voltage components
7. High frequency circuits
8. X-ray tube components
    - Tube housing and envelope
    - Cathode and anode
    - Tube and filament currents
    - Line focus principle
    - Heel effect
    - Heat unit

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B 9** Screen film radiograph

Instructor Amphai Uraiverotchanakorn
อาจารย์ อำไพ อุไรเวโรจนากร

Learning objectives : At the end of the session, the student should be able to

1. Identify the construction of radiographic film
2. Describe the formation of the latent image
3. Identify the types of film
4. Identify the information of the intensifying screen and fluorescence screen
5. Identify the information of film processing
6. Describe proper storage and handling procedures for film

Learning contents :

1. Film construction

Base

Emulsion

2. Formation of the latent image

Silver Halide crystal

Latent image

3. Types of film

3.1 Handling and storage of film

Methods :

1. Lecture

Media :

1 Computer and LCD projector

2 Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B10** Fluoroscopy

Instructor Assistant Professor Sawwanee Asavaphatiboon
ผู้ช่วยศาสตราจารย์ เสาวนีย์ อัศวผาติบุญ

Learning objectives: At the end of the session, the student should be able to

1. Describe the basic principle of fluoroscopy
2. Describe the components of the fluoroscopic equipment
3. Describe the basic function of the image intensifier
4. Identify fluoroscopic modes of operation
5. Describe the importance of display device for fluoroscopy
6. Describe the radiation dose from fluoroscopy

Learning contents:

1. Basic principle of fluoroscopy
2. Fluoroscopy equipment
3. Image intensifier
4. Display devices

Methods: Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B11** Computed Tomography

Instructor Associate Professor Dr.Anchali Krisanachinda

รองศาสตราจารย์ ดร.อัญชลี กฤษณจินดา

Learning objectives : At the end of the session, the student should be able to

1. Describe the operation of a computed tomography (CT) scanner
2. Identify the components of a CT scanner
3. Define CT number
4. Identify the factors influence the spatial and contrast resolution

Learning contents :

1. Component 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 scanner
5. Radiation dose from CT scanner
6. Radiation safety for personnel
7. Quality control for CT

Methods :

Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B12** MRI

Instructor: Assistant Professor Dr.Pairash Saiviroonporn
ผู้ช่วยศาสตราจารย์ ดร.ไพรัช สายวิรุณพร

Learning objectives : At the end of the session, the student should be able to

1. Understand about the basic MR physics, instrumentation, pulse sequence and safety.

Learning contents :

1. Principle of MRI
2. MR Instrument
3. Basic MR pulse sequences (Spin-echo and Gradient-echo)
4. Type of MR images (T1w, T2w, PD2 images)
5. Suppression and cancellation techniques
6. Safety

Methods :

Lecture

Time: 1 hr.

Media :

PC power point and lecture note

Evaluation :

Written examination (MCQ)

Study Plan

Subject : Medical Radiation Physics

Topics : **B 13** Radiotherapy Equipment

Instructor : Taweap Sanghangthum

อาจารย์ทวีป แสงแห่งธรรม

Learning objectives : At the end of the course, the student should be able to

1. Describe the basic principle of teletherapy machines and the support equipments
2. Explain the application of teletherapy machines
3. Explain the methods of brachytherapy

Learning contents :

1. Radiation treatment machines: Kilovoltage unit, Co-60 teletherapy unit, linear accelerator,
2. X-ray simulator, CT simulator, cone beam CT, treatment planning system, respiratory gating portal imaging
3. Immobilization : orfit, alpha cradle, vac-loc , etc.
4. Brachyherapy

Methods :

1. Lecture 1 hour

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject : Medical Radiation Physics

Topic : **B14** : Introduction in radiopharmaceuticals (1)

Design and production

Instructor: Associate Professor Nopamon Sritongkul

รองศาสตราจารย์ นภมน ศรีตงกุล

Learning objectives : At the end of the session, the student should be able to

1. Explain the design and production of radiopharmaceutical.
2. Describe the ideal radiopharmaceutical for diagnostic and therapeutic.
3. Discuss the mechanism of localization.

Learning contents :

1. Design characteristics of radiopharmaceutical.
2. Production of radionuclide.
3. Ideal radiopharmaceutical for diagnostic and therapeutic.
4. Radionuclide generators.
5. Types of radiopharmaceutical.
6. Mechanism of localization.

Method : Lecture

Media : 1. Computer and LCD projector.

1. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B15** (1) Radionuclide imaging

Instructor Associate Professor Dr.Anchali Krisanachinda

รองศาสตราจารย์ ดร.อัญชลี กฤษณจินดา

Learning objectives : At the end of the session, the student should be able to

1. Describe the components of the gamma camera
2. Describe the basic principle of the radionuclide imaging device
3. Describe the principle of a digital camera
4. Describe the performance of the gamma camera
5. Describe the quality control program of a gamma camera

Learning contents :

1. Components os a gamma camera
2. Principle of operation
3. Digital camera
4. Performance parameter of a gamma camera
5. Quality control of a gamma camera

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B15(2)** Radionuclide Imaging

Instructor Associate Professor Dr.Rujaporn Chanachai

รองศาสตราจารย์ ดร.รุจพร ชนะชัย

Learning objectives : At the end of the session, the student should be able to

1. Describe the digital computer and major hardware components
2. Describe the A/D converter for Gamma camera/computer interface
3. Describe the position determination of gamma camera detector
4. Identify the difference of list mode and matrix mode acquisition
5. Describe the principle basis of SPECT system
6. Describe the SPECT acquisition and reconstruction technique
7. Describe the principle basis of PET, PET/CT and Cyclotron
8. Describe the clinical application of PET/CT

Learning contents : Digital imaging system, SPECT, PET

1. Computing terminology and the function of major hardware components of digital computer used in nuclear medicine
2. The representation and storage of numbers and images in digital computer
3. The capabilities and operation of the gamma camera/computer interface
4. Data acquisition mode in nuclear medicine imaging system
5. List mode and Matrix mode
6. Physical basis of SPECT
7. SPECT acquisition and reconstruction technique
8. SPECT quality assurance
9. Basic principles of PET and Cyclotron
10. Clinical of PET/CT application

Methods : Lecture

Media : 1. Computer and LCD projector

Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B15(3)** In VIVO studies

Instructor Associate Professor Dr.Rujaporn Chanachai

รองศาสตราจารย์ ดร.รุจพร ชนะชัย

Learning objectives : At the end of the session, the student should be able to

1. Describe the principle of in vivo studies using nuclear medicine technique
2. Define and identify the difference between radioactive tracer and indicator
3. Identify the difference of single and multiple compartmental model
4. Describe the tracer dilution principle and solve problem

Learning contents :

1. Tracer principles
2. Radioactive tracer and indicator
3. Compartmental system and modeling
4. Single and multiple model
5. Tracer dilution principle

Methods :

1. Lecture

Media :

Computer and LCD projector

2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B16** Bone density measurement

Instructor Oranuch Tiapetch

อาจารย์อรนุช เตียะเพชร

Learning objectives: At the end of the session, the student should be able to

1. Describe the basic principle of bone mineral density
2. Describe the historical design of the equipment
3. Describe the principle of SPA, DPA, SPX, DPX
4. Describe the radiation dose from BMD equipment

Learning contents:

1. Basic principles of bone mineral density
2. Historical background of equipment design
3. Principles of SPA, DPA, SPX, DPX
4. Radiation dose from BMD equipment

Methods:

lecture

Media:

1. Computer and LCD projector
2. Handout

Evaluation

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B17** Radiation protection in diagnostic radiology

Instructor Associate Professor Dr.Anchali Krisanachinda

รองศาสตราจารย์ ดร.อัญชลี กฤษณจินดา

Learning objectives : At the end of the session, the student should be able to

1. Describe the basic principles of radiation protection
2. Describe the methods of radiation dose reduction
3. Describe the method of patient dose reduction
4. Describe the requirement for personnel monitoring
5. Describe the components of natural background radiation

Learning contents :

1. Basic principles of radiation protection
2. Reduction of radiation exposure of the staff
3. Reduction of radiation dose to the patients
4. Regulations, equipment regulations
5. Radiation detectors
6. Natural background radiation
7. Proper radiological techniques in diagnostic imaging

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B18** Radiation protection in nuclear medicine

Instructor Tanawat Sontarapornpol

อจารย์ ธนวัฒน์ สนทราพรพล

Learning objectives : At the end of the session, the student should be able to

2. Describe the classification of working area.
3. Describe the radiation hazard from unsealed radioactive source.
4. Describe the radioactive protection from unsealed radioactive source.
5. Describe the safe handling of radionuclides.
6. Describe the monitoring of the work space and public exposure.
7. Describe the emergency plan.
8. Describe the radiation contamination and decontamination.
9. Describe the methods of radioactive waste disposal.
10. Describe the rules and regulations of the transportation of radionuclides.

Learning contents :

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

Methods :

Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B1**9 Radiation Protection in Radiotherapy

Instructor Assistant Professor Surat Vinijsorn
ผู้ช่วยศาสตราจารย์ สุรัตน์ วินิจสร

Learning objectives : At the end of the session, the student should be able to

1. Describe the regulatory requirement for radiation protection.
2. Describe structural shielding design for Cobalt-60, Linear Accelerator and brachytherapy rooms
3. Describe the radiation safety in the radiation oncology unit.

Learning contents :

1. Regulatory requirements
2. Structural shielding design
3. Operational safety guidelines

Method:

1. Lecture

Media:

1. Computer and LCD projector
2. Handout

Evaluation:

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **B20** การกำกับดูแลความปลอดภัยทางรังสี

Instructo อาจารย์ กิตติศักดิ์ ชินอุดมทรัพย์

Learning objectives : At the end of the session, the student should be able to

1. Describe the regulation for radiation workers
2. Describe the responsibility of the director of the medical radiation establishment
3. Describe the method to apply for the owner and usage of radioactive substance in medicine

Learning contents :

1. Regulation for radiation workers in Thailand
2. Responsibility for the director of the medical radiation establishment
3. Application for the owner of medical radiation establishments
4. Application for the import and usage of radioactive substance in medicine.

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D1** Introduction to radiographic technique

Instructor Amphai Uraiverotchanakorn

อาจารย์ อำไพ อุไรเวโรจนากร

Learning objectives : At the end of the session, the student should be able to

1. Describe the prime exposure factors
2. Identify milliampere-second and kilovolt peak in relation to x-ray beam quantity and quality
3. Define radiographic quality ,resolution, noise and speed
4. Describe the subject factors affecting radiographic quality

Learning contents :

1. Exposure factors
   - 1.1 kVp
   - 1.2 mA
   - 1.3 Exposure time
   - 1.4 mAs
   - 1.5 Distance
2. Imaging System Characteristics
   - 2.1 Focal-Spot size
   - 2.2 Filtration
   - 2.3 High-Voltage Generation
3. Tools for Improved Radiographic quality
   - 3.1 Patient
   - 3.2 Image receptors
   - 3.3 Selection of Technique Factors

Methods : 1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation : Written examination **(MCQ)**

Study Plan

Subject Medical Radiation Physics

Topic **D2** Basic principle of digital imaging

Instructor Assistant Professor Dr. Napapong Pongnapang
ผู้ช่วยศาสตราจารย์ ดร.นภาพงษ์ พงษ์นภางค์

Learning objectives : At the end of the session, the student should be able to

1. Describe physical principle of digital radiography
2. Describe factors affecting image quality and radiation dose in digital imaging
3. Describe basic image processing

Learning contents :

Digital Radiography

1. Photostimulable phosphor
2. Digital imaging modalities
3. Digital image processing methods
4. Image quality in digital imaging

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D3** Quality assurance in diagnostic x-ray equipment

Instructor Assistant Professor Dr.Napapong Pongnapang
ผู้ช่วยศาสตราจารย์ ดร.นภาพงษ์ พงษ์นภางค์

Learning objectives : At the end of the session, the student should be able to

1. Describe concepts of quality assurance and quality control in radiology
2. Describe factors affecting image quality
3. Describe common types of image artifacts
4. Describe factors affecting patient dose

Learning contents :

1. Radiological imaging quality control factors
2. Image artifacts
3. Quality control requirements and roles of radiologist

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D4** Mammography

Instructor Assistant Professor Dr.Napapong Pongnapang
ผู้ช่วยศาสตราจารย์ ดร.นภาพงษ์ พงษ์นภางค์

Learning objectives: At the end of the session, the student should be able to

1. Describe physical principle of screen film and digital mammography
2. Describe physical principle of conventional tomography
3. Describe factors affecting image quality and radiation dose in mammography
4. Describe requirements for quality management in mammography

Learning contents:

Mammography

1. screen film mammography
2. digital mammography
3. image quality
4. mean glandular dose and justification
5. MQSA

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D5** Advanced computed tomography

Instructor Assistant Professor Dr. Napapong Pongnapang
ผู้ช่วยศาสตราจารย์ ดร.นภาพงษ์ พงษ์นภางค์

Learning objectives: At the end of the session, the student should be able to

1. Describe physical principle of MDCT
2. Describe factors affecting image quality and patient dose in MDCT
3. Describe justifications for radiologist regarding MDCT examinations
4. Describe basic quantitative analysis used in MDCT
5. Describe advance techniques in CT

Learning contents:

MDCT

1. system design
2. image quality and dose
3. justifications
4. quantitative analysis
5. quality control

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D6** Ultrasound

Instructor Thunpong Krisanachinda

อาจารย์ ธันพงษ์ กฤษณจินดา

Learning objectives : At the end of the session, the student should be able to

1. Describe the properties of ultrasound
2. Describe the principle of a transducer
3. Explain the acoustic impedance
4. Identify the axial and lateral resolution
5. Describe the principle of an ultrasound instruments
6. Describe the principles of Doppler ultrasound
7. Describe the quality assurance program and preventive maintenance of ultrasound system

Learning contents :

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

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D7** Advanced MRI

Instructor Assistant Professor Dr.Pairash Saiviroonporn
ผู้ช่วยศาสตราจารย์ ดร.ไพรัช สายวิรุณพร

Learning objectives : At the end of the session, the student should be able to

1. Describe the advanced topics in MR imaging and applications

Learning contents :

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, and BOLD)

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D8** PACS

Instructor Dr.Thanongchai Siriapisith
นายแพทย์ทนงชัย สิริอภิสิทธิ์

Learning objectives : At the end of the session, the student should be able to

2. Identify the information principle in PACS
3. Identify the information display system
4. Describe the connection of basic PACS and Teleradiology
5. Identify the information of DICOM format
6. Identify the Storage systems

Learning contents :

1. PACS
2. Display systems
3. Server
4. Network
5. Storage system

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **D9** Concept of Image Quality

Instructor Assistant Professor Dr. Napapong Pongnapang

ผศ. ดร.นภาพงษ์ พงษ์นภางค์

Learning objectives : At the end of the session, the student should be able to

1. Describe concept of physical image quality
2. Describe factors affecting image quality
3. Describe significance of image quality related to clinical interpretations by radiologist

Learning contents :

1. Contrast
2. Spatial resolution
3. Noise
4. Relationships among physical image quality factors

Methods :

Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject : Medical Radiation Physics

Topic : **N1** Radiopharmaceuticals

Preparation and quality control.

Instructor: Associate Professor Nopamon Sritongkul

รองศาสตราจารย์ นภมน ศรีตงกุล

Learning objectives : At the end of the session, the student should be able to

1. Describe the preparation the radiopharmaceutical in hospital.
2. Differentiate the purity and contaminant of radiopharmaceutical.
3. Describe the analytical methods of radiopharmaceutical quality control.
4. Measure the efficiency of labeling.

Learning contents :

1. Principle of radiopharmaceutical preparation in hospital.
2. Methods of labeling with ^{99m}Tc.
3. Purity of radiopharmaceutical.
4. Quality control and the tests of radiopharmaceuticals.

Method : Lecture

Media : 1. Computer and LCD projector.

2. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **N2** Survey of radiation detection system in nuclear medicine

Instructor Associate Professor Malulee Tuntawiroon
รองศาสตราจารย์ มลุลี ตันฑวิรุฬห์

Learning objectives: At the end of the session, the student should be able to

1. Describe the physical process of radiation detection and their components.
2. Understand the different categories of radiation detectors
3. Define and terms efficiency, energy resolution, energy discrimination and dead time.
4. Describe the characteristics and function of each of the radiation detection devices found in clinical nuclear medicine setting.

Learning contents:

1. Gas-filled detectors : Theory of gas ionization and collection, Dose calibrator
2. Scintillation detectors : Theory of light emission and collection
3. Semiconductors
4. Radiation protection detectors : Survey meters
5. NaI(Tl) and other scintillation detection systems : Physical properties, absorption of photons, PMT, energy spectrometry, pulse height spectrum, energy resolution and detection efficiency
6. Probe detectors : Organ uptake measurement , thyroid uptake system and neck phantom
7. PET detectors
8. Liquid scintillation counting system : Applications
9. Semiconductor detectors : Applications
10. Whole body counting and applications

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject **Medical Radiation Physics**

Topic **N3 Radionuclide counting and statistics** (2 hours)

Instructor Associate Professor Malulee Tuntawiroon
รองศาสตราจารย์ มลุลี ตัณฑวิรุฬห์

Learning Objectives: At the end of the session**,** the student will be able to understand

1. The problems associated with low count statistics in nuclear medicine.
2. The types of errors that can occur during a measurement.
3. How confidence intervals can be used to establish a degree of confidence in a result.
4. The effect of low count statistics on object detectability.
5. How to evaluate the information content of a test in terms of sensitivity, specificity, PPV, NPV, and ROC analysis.
6. how to measure inter-observer variability.

Learning Contents:

1. Probability distributions
2. Counting statistics: Precision and accuracy
3. Confidence limits
4. Statistics of imaging
5. Evaluation of the information content of a test
6. Sensitivity and specificity
7. Pre and Posttest probabilities: Predictive value of positive and negative test results
8. Kappa statistics
9. Receiver operating characteristics (ROC)

Methods: Lecture

Media: 1. Power point handouts
2. Computer and LCD projector

Evaluation: Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **N4** Internal radiation dosimetry

Instructor Tanawat Sontrapornpol

อาจารย์ ธนวัฒน์ สนทราพรพล

Learning objectives : At the end of the session, the student should be able to

1. Determine the patient radiation dose from the radionuclide treatment and investigation
2. Describe the radiation exposure from the target organ
3. Describe the cumulative activity from various internal organs
4. Describe the optimum radiation dose in pregnant and pediatric.

Learning contents :

1. Absorbed dose calculation
2. Essential data needed for calculation
3. Time-activity curve
4. Cumulative activity
5. Residence time
6. Single exponential fit
7. Multiple exponential fit
8. Radiation absorbed dose estimation

Methods :

1. Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject : Medical Radiation Physics.

Topic : **N5** Radioimmunoassay and related procedures.

Instructor: Associate Professor Nopamon Sritongkul.
รองศาสตราจารย์ นภมน ศรีตงกุล

Learning objectives : At the end of the session, the student should be able to

1. Explain the basic principle of RIA and related techniques.
2. Select the optimum test for the diagnostic of thyroid function and tumor marker for cancer investigation.

Learning contents :

1. Basic principle of RIA and related techniques.
2. In-vitro thyroid function tests and their applications
3. Tumor markers and their applications.

Method : Lecture

Media : 1. Computer and LCD projector.
2. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject : Medical Radiation Physics

Topics : **T1**: Photon beams

Instructor : Associate Professor Sivalee Suriyapee

รองศาสตราจารย์ ศิวลี สุริยาปี

Learning objectives : At the end of the course, the student should be able to

1. Describe the characteristic of beam in the treatment field
2. Explain the parameters used in radiation treatment
3. Describe the definitions of the terms used in dose distribution

Learning contents :

1. Definition of phantom, output, primary radiation, scattered radiation, builds up region, electronic equilibrium, and skin sparing effect.
2. Definitions of PDD,BSF,TAR,SAR,TMR,TPR,SMR,
3. Depth dose distribution: isodose curves, given dose, skin dose, exit dose, target dose

Methods

1. Lecture 2 hours

Media :

1. Computer and LCD projector
2. Handout

Evaluation : Written examination (MCQ)

StudyPlan

Subject : Medical Radiation Physics

Topics : **T2**: Electron and particle beams

Instructor : Associate Professor Sivalee Suriyapee

รองศาสตราจารย์ ศิวลี สุริยาปี

Learning objectives : At the end of the course, the student should be able to

1. Describe the dosimetric parameters and treatment planning of electron beams
2. Explain the characteristic of heavy particles and their clinical used

Learning contents :

1. Electron beams :
   1.1 Beam characteristics: energy determination, depth dose, isodose curves, output factors
   1.2 Treatment planning: conventional techniques, advance techniques of total skin irradiation and electron arc therapy
2. Particle beams; fast neutron, protons and heavy particles
   2.1 Beam characteristics
   2.2 Experienced of using particle beams

Methods :

Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject : Medical Radiation Physics

Topics : **T3**: Radiation Therapy Treatment Planning

Instructor : Assistant Professor Surat Vinijsorn
ผู้ช่วยศาสตราจารย์ สุรัตน์ วินิจสร

Learning objectives : At the end of the course, the student should be able to

1. Describe the acquisition of patient data for radiation treatment planning
2. Explain the method of patient immobilization
3. Describe the planning methods

Learning contents :

1. Acquisition of patient data
2. Immobilization
3. Beam modification and beam direction device
   - 3.1 Shielding
   - 3.2 Tissue compensator
   - 3.3 Wedge filter
   - 3.4 Front and back pointer
4. Combination fields
5. Oblique incidence and its convection
6. Prescribing, recording and reporting

Methods :Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **T4** Brachytherapy

Instructor Assistant Professor Chirapha Tannanonta

ผู้ช่วยศาสตราจารย์จีระภา ตันนานนท์

Learning objectives : At the end of the session, the student should be able to

1. Describe the definition of brachytherapy
2. Describe the definition of low dose rate, medium dose rate and high dose rate brachytherapy
3. Describe the principal properties of the radioactive sources used for brachytherapy
4. Describe the definition of points A and B
5. Prescribe and report dose for brachytherapy
6. Describe the advantages and disadvantages of the HDR brachytherapy comparing with the LDR
7. Describe the principle of radiation protection in brachytherapy

Learning contents:

1. Introduction
   a. Definition of brachytherapy
   b. Techniques
   c. Brachytherapy dose rate
2. Brachytherapy sources
3. Dosimetry systems
4. Radiobiological models
5. Comparing of HDR and LDR in brachytherapy
6. Radiation protection for brachytherapy

Method Lecture

Media : 1. Computer and LCD projector
2. Handout

Evaluation : Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **T5** Advanced in Radiotherapy

Instructor Assistant Professor Chumpot Kakanaporn

ผู้ช่วยศาสตราจารย์ จุมพฏ คัคนาพร

Learning objectives : At the end of the session, the student should be able to

1. Understand the concepts of SRS and SRT,3D-CRT, IMRT, and TBI
2. Describe treatment planning and delivery of SRS, SRT, 3D-CRT, IMRT and TBI
3. Identify the clinical use of SRS, SRT,3D-CRT,IMRT and TBI
4. Identify the treatment verification of 3D-CRT and IMRT
5. Identify quality assurance of TBI

Learning contents :

1. Stereotactic Radiosurgery (SRS) and Stereotactic Radiotherapy (SRT)
   - 1.1 Definition of SRS and SRT
   - 1.2 Treatment system are available for SRS
   - 1.3 Physical and clinical requirements for SRS and SRT
   - 1.4 Ancillary equipments of SRS
2. Three Dimensional Conformal Radiation Therapy (3D-CRT) and Intensity Modulated Radiation Therapy (IMRT)
   - 2.1 Concept of 3D-CRT and IMRT
   - 2.2 Treatment planning of 3D-CRT and IMRT
   - 2.3 Treatment delivery and verification for 3D-CRT and IMRT
   - 2.4 Clinical use of 3D-CRT and IMRT
   - 2.5 Implementation of 3D-CRT and IMRT.
3. Total Body Irradiation (TBI)
   - 3.1 Physical and clinical requirement for TBI
   - 3.2 Treatment technique and equipment
   - 3.3 Quality assurance in TBI

Methods :

1. Lecture

Media :

1.Computer and LCD projector

2.Handout

Evaluation :

Written examination (MCQ)

Study Plan

Subject Medical Radiation Physics

Topic **T6** Quality assurance / quality control in Radiotherapy

Instructor Assistant Professor Chumpot Kakanaporn
ผู้ช่วยศาสตราจารย์ จุมพฏ คัคนาพร

Learning objectives : At the end of the session, the student should be able to

1. Identify the uncertainties in treatment process.
2. Describe the concepts of Quality Assurance and Quality Control.
3. Understand the responsibility of staff in radiation therapy
4. Describe the implications of different treatment units and their design
5. Identify the method of treatment verification.

Learning contents :

1. Error analysis of treatment process
   1.1 Dosimetric uncertainties
   1.2 Geometric uncertainties
2. QA concept and terminology
3. Qualified staffs
4. Equipments in radiation therapy
5. In vivo dosimetry and portal verification
6. Clinical implement of purchased technology

Methods :

1 Lecture

Media :

1. Computer and LCD projector
2. Handout

Evaluation :

Written examination (MCQ)

Radiobiology for Residents in Radiology

Course Contents

	Lecture hour	Students
A. Basic Molecular Cell Biology	4	D, N, T
- Basic concepts in molecular cell biology	3	
- Molecular techniques in Radiobiology	1	
B. Basic Radiation Biology	10	D, N, T
1.Molecular aspects of radiobiology		
-Action of ionizing radiation on cells	1.5	
-Molecular response to radiation action	0.5	
2 Biological basis of radiotherapy	4	
-Proliferation kinetics and normal organ response		
-Tumor growth kinetics and tumor organ response		
-Analysis of cell survival curve		
-Five R's in radiotherapy		
C. Clinical Radiation Biology	7	T
1. Applications of radiobiological concepts in Radiotherapy	4	
-Conventional fractionation		
-Hyperfractionation		
-Accelerated fractionation		
-Brachytherapy (LDR and HDR)		
-Stereotactic radiosurgery (SRS) and radiotherapy (SRT)		
-Intraoperative radiotherapy (IORT)		
-Particle beam therapy		
2. Radiosensitizers and radioprotectors	1	
3. Radiation and immunity	1	
4. Clinical radiation pathology	1	
D. Health Effects of Ionizing Radiations	5	D, N, T
1. Acute effects of total body irradiation	2	
2. Radiation carcinogenesis	1	
3. Effects of ionizing radiations on embryo and fetus	1	

4	Genetics effects of ionizing radiation	0.5
5.	Radiation cataractogenesis	0.5