Miami Dade College

Course Description

NMT2779C | Multi-Modalities and Cross-Sectional Anatomy | 2.00 credits

This course educates the student upon proper recognition and interpretation of cross-sectional anatomy. The student will also compare and analyze images from complementary modalities. It is crucial for the nuclear medicine technologist to understand three-dimensional imaging in order to enhance patient care and be an asset to the facility. Prerequisites: NMT2130C, NMT2723C, NMT2814C; Corequisites: NMT2733C, NMT2824C

Course Competencies:

Competency 1: The student will be able to demonstrate Positron Emission Tomography (PET) radiation safety concerns by:

1. Examining the concepts of personal protection/monitoring:
    a. As low as (is) reasonably achievable (ALARA)
    b. Personal protection
    c. Control room
    d. Distance
    e. Dose calibrator
    f. Patient dose
    g. Patient holding room
    h. Scanning room
    i. Shielding
    j. Time
    k. Waiting room
    l. Waste c. Personal monitoring devices (body/extremity)
    m. Examining the concepts of area/facilities monitoring
    n. Survey Equipment
    o. Radiation surveys
    p. Regulatory requirements
2. Examining the concepts of packaging and storing radioactive materials, inspection of incoming/outgoing materials, and storing radiopharmaceuticals
3. Analyzing the significance of keeping records, including those involving shipping, receipt, administration, storage, the disposal of radioactive materials, and radiation surveys
4. Indicating the implications of radioactive decontamination to the area and personnel
5. Summarizing the significance and concerns regarding the disposal of radioactive waste, its release to the environment, the concept of decay to storage, incineration and the transfer to authorized recipients

Competency 2: The student will be able to demonstrate PET/Computed Tomography (CT) scans by:

1. Examining Scintillation detector systems: Principles of scintillation detection, Properties of detector materials:
    a. Material types
    b. Atomic number
    c. Delay timed
    d. Conversion efficiency-PET detector materials:
        - Sodium iodide (Nal)
        - Bismuth germinate (BGO)
        - Lutetium oxyorthosilicate (LSO)
        - Gadolinium oxy orthosilicate (GSO)
2. Examining System types: Terminology:
    a. Aperture size-Field of view-Overlap-Bed positions
    b. Dedicated PET
    c. Full ring tomography

d. Partial ring tomography
e. Panel detector
f. PET-CT combined
g. Gamma PET camera

3. Identifying anatomy and physiology:
    a. Listing indications
    b. Listing contrast media and recommended volumes
    c. Discussing patient preparation
4. Examining Quality Control procedures: Normalization-Blank Scan-Gains (singles)-Cross-calibration:
    a. System performance
    b. Scatter fraction
    c. Noise equivalent count rated
    d. National Electrical Manufacturers Association (NEMA) standards and testing
5. Examining CT System Principles, Operations, and Components:
    a. Tube
    b. kVp
    c. mA
    d. Warm-up procedures
    e. Generator and Transformers
    f. Detector (single and multi-row) and DAS
    g. Collimation
    h. Computer and Array Processor
    i. Equipment Maintenance
6. Analyzing image formation and reconstruction

Competency 3: The student will be able to demonstrate PET/Magnetic Resonance Imaging (MRI) scans by:

1. Examining Scintillation detector systems: Principles of scintillation detection, Properties of detector Materials:
    a. Material types
    b. Atomic number
    c. Delay timed
    d. Conversion efficiency-PET detector materials:
        - Sodium iodide (Nal)
        - Bismuth germinate (BGO)
        - Lutetium oxyorthosilicate (LSO)
        - Gadolinium oxyorthosilicate (GSO)
2. Discussing and examining System types
3. Examining MRI Instrumentation-Magnet:
    a. Types of magnets - permanent, resistive, and superconductive
    b. Magnetic and RF fields
    c. Gradients
    d. Cross section of a magnet
    e. Transmit and receive:
    f. Coils
    g. Receive only
    h. Transmit/receive
    i. Linear
    j. Quadrature
    k. Phased array
    l. Multichannel
    m. Shielding and shimming -both active and passive
4. Examining the following terms:
    a. Hertz (HZ), megahertz (MHZ)
    b. Tesla (T), gauss (g)
    c. Electromagnetic spectrum

5. Analyzing computer and digital imaging
6. Examining MRI obtaining the MR Signal:
    a. Properties of hydrogen and molecular structure
    b. Precession
    c. Net magnetization
    d. Angular momentum
    e. Magnetic domain
    f. Vector
    g. Resonance
    h. Larmour equation
    i. Faraday's laws
    j. RF pulses
    k. Spatial localization
    l. Paramagnetic
    m. Diamagnetic
    n. Super magnetic
    o. K-space
    p. Fourier transform, half and partial Fourier
    q. 2-D/3-D imaging
    r. Magnetization transfers
    s. Filming
    t. Windows and levels
    u. Region of interest (ROI)
    v. Annotations
    w. Remote workstations (imaging manipulation)
7. Archiving and data storage
8. Examining tissue contrast
9. Discussing extrinsic factors

Learning Outcomes:

- Communicate effectively using listening, speaking, reading, and writing skills
- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information
- Use computer and emerging technologies effectively