### NMT 2779C  Multi-Modalities and Cross-Sectional Anatomy

**Course Description:**
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: NMT 2130C, NMT 2723C, NMT 2814C; Corequisites: NMT 2733C, NMT 2824C. (1 hr. lecture, 2 hr. lab)

<table>
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<th>Competency 1: The student will be able to demonstrate Positron Emission Tomography (PET) radiation safety concerns by:</th>
<th>Learning Outcomes</th>
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| 1. Examining the concepts of personal protection/monitoring:  
  a. As low as (is) reasonably achievable (ALARA)  
  b. Personal protection:  
    i. Control room  
    ii. Distance  
    iii. Dose calibrator  
    iv. Patient dose  
    v. Patient holding room  
    vi. Scanning room  
    vii. Shielding  
    viii. Time  
    ix. Waiting room  
    x. Waste  
  c. Personal monitoring devices (body/extremity)  
  2. Examining the concepts of area/facilities monitoring:  
    a. Survey equipment  
    b. Radiation surveys  
    c. Regulatory requirements  
  3. Examining the concepts of packaging and storage of radioactive materials, inspection of incoming/outgoing materials and the storage of radiopharmaceuticals. | • Communication  
• Numbers / Data  
• Critical thinking  
• Information Literacy  
• Computer / Technology Usage |
4. Analyzing the significance of keeping records including those involving shipping, receipt, administration, storage, the disposal of radioactive materials and radiation surveys.
5. Indicating the implications of radioactive decontamination to the area as well as to personnel.
6. Summarizing the significance and concerns regarding the disposal of radioactive waste, its release to 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. Conversion efficiency-PET detector materials:
      i. Sodium iodide (Nal)
      ii. Bismuth germinate (BGO).
      iii. Lutetium oxyorthosilicate (LSO).
      iv. Gadolinium oxyorthosilicate (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
4. Listing indications.
5. Listing contrast media and recommended volumes.
7. Examining Quality Control procedures: Normalization-Blank Scan-Gains (singles)-Cross-calibration:

- Communication
- Numbers / Data
- Critical thinking
- Information Literacy
- Computer / Technology Usage

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8. 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

**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. Conversion efficiency-PET detector materials:
      I. Sodium iodide (NaI)
      II. Bismuth germinate (BGO)
      III. Lutetium oxyorthosilicate (LSO)
      IV. Gadolinium oxyorthosilicate (GSO)
2. Discussing and examining System types
3. Examining MRI Instrumentation-Magnet:
   a. Types of magnets - permanent, resistive and super conductive
      b. Magnetic and RF fields
      c. Gradients
      d. Cross section of a magnet
      e. Transmit and receive:

• Communication
• Numbers / Data
• Critical thinking
• Information Literacy
• Computer / Technology Usage
I. Coils
II. Receive only
III. Transmit/receive.
IV. Linear.
V. Quadrature.
VI. Phased array.
f. Multichannel. 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 imaging-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
   I. Windows and levels.
   II. Region of interest (ROI).
   III. Annotations
t. Remote workstations (imaging manipulation)
u. Archiving and data storage

7. Examining tissue contrast

8. Discussing extrinsic factors