



# BROWARD COMMUNITY COLLEGE COURSE OUTLINE

**LAST REVIEW:** 2010-2011      **NEXT REVIEW:** 2015-2016      **STATUS:** A

**COURSE TITLE:** Introduction to Nuclear Medicine Laboratory

**COMMON COURSE NUMBER:** NMT 1002L

**CREDIT HOURS:** 1

**CONTACT HOUR BREAKDOWN**

*(per 16 week term)*

**CLOCK HOURS:**

*(Voc. Course ONLY)*

Lecture:                      Lab:      32

Clinic:                        Other:

**PREREQUISITE(S):**

**COREQUISITE(S):**

**PRE/COREQUISITE(S):** NMT 1002

## **COURSE DESCRIPTION**

Introduces the student to the fundamentals of clinical nuclear medicine primarily through practice of material that is learned in NMT 1002.

## **UNIT TITLES**

1. Patient Care & Safety
2. Radiation Safety
3. ALARA
4. Dose Calibrator
5. Radiopharmaceuticals
6. Survey Meter
7. Probe & Well
8. Gamma Camera
9. Quality Control
10. Computer Procedures
11. Clinical Procedures



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## **ASSESSMENT:**

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.

- 1. Assessment of reading assignments via submission of homework projects;**
- 2. Pre-lab exercises;**
- 3. Skill Checks and Practical Examinations to assess competency**



**Common Course  
Number:**                      **NMT  
1002L**

**Unit 1 Patient Care and Safety**

**General Outcome:**

**1.0 The student shall be able to demonstrate an understanding of patient care and safety.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 1.1** Describe the steps taken by the NM technologist to protect patients' belongings while she/he is in the Nuclear Medicine Department.
- 1.2** Discuss the procedure to be followed when interviewing a patient for a NM procedure, including:
  - a. Patient greeting/identification
  - b. Introduction to the patient
  - c. Patient preparation for the required procedure
  - d. Explanation of the procedure to be performed
  - e. Follow-up care
- 1.3** Describe the proper method for assisting a patient with a bedpan or urinal.
- 1.4** Describe the correct manner of moving or transferring patients to prevent injury to the patient or NM technologist.
- 1.5** Describe the correct positioning of a patient to maintain good body alignment.
- 1.6** Discuss the use of pillows or sponges for assuring patient comfort and stability during procedures in the Nuclear Medicine Department.
- 1.7** Discuss the proper use of safety straps, side rails and restraints in the NM Department.
- 1.8** Define Body Mechanics.
- 1.9** State three reasons for practicing proper body mechanics.
- 1.10** State the leading cause of injury among health care workers.
- 1.11** List three rules for proper body mechanics.
- 1.12** Explain the terms, "Center of Gravity" and "Base of Support."



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**Unit 2 Radiation Safety**

**General Outcome:**

**2.0 The student shall be able to demonstrate an understanding of Radiation Safety.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 2.1** Recommend appropriate techniques used in the application of principles of time, distance, and shielding for radiation safety practices.
- 2.2** Name and describe the various types of licenses for use of radioactive materials in medical practice.
- 2.3** Cite NRC/HRS regulations regarding the posting of work place and instructions to workers.
- 2.4** State circumstances where improper actions or incidents require notification to the radiation safety officer and/or NRC/HRS office.
- 2.5** State the responsibilities of the Radiation Safety Officer and the Radiation Safety Committee in the implementation of ALARA.
- 2.6** State the NRC/HRS regulations regarding the use of labeling of syringe and vial shields.
- 2.7** State the NRC/HRS regulations regarding calibration of patient doses and records that must be maintained regarding each administered dose.
- 2.8** State NRC/HRS requirements room preparation and monitoring for use of aerosols and/or gases including traps and disposable materials.
- 2.9** State the basic considerations of disaster planning and define the NM technologist's role in community disaster planning.



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**Unit 3 ALARA**

**General Outcome:**

**3.0 The student shall be able to demonstrate an understanding of ALARA.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 3.1** Discuss the concept of ALARA as it applies to the practice of nuclear medicine.
- 3.2** Describe management's commitment to ALARA.
- 3.3** Describe ways to maintain exposures within ALARA principles.
- 3.4** Explain the Radiation Safety Officer's responsibilities and delegation of authority.
- 3.5** Explain the Radiation Safety Committee's responsibilities, composition, frequency of meetings and records that must be maintained.
- 3.6** Misadministration: diagnostic and therapeutic - definition, reporting, written record and retention.
- 3.7** Discuss the difference between investigational levels I and II.



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**Unit 4 Personnel Monitoring**

**General Outcome:**

- 4.0 The student shall be able to demonstrate an understanding of personnel monitoring.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 4.1** List the various types of personnel monitors and state the intended use of each type of monitor.
- 4.2** Discuss NRC/HRS regulations involving personnel monitoring.
- 4.3** Explain bioassay procedure, record keeping and follow-up.
- 4.4** Explain bioassay procedure, record keeping and follow-up.



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**Unit 5 Dose Calibrator**

**General Outcome:**

**5.0 The student shall be able to demonstrate an understanding of Dose Calibrator.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 5.1** List and describe the quality control procedures that must be completed for the dose calibrator.
- 5.2** Perform dose calibrator quality control checks and determine whether the instrument is functioning within accepted limits.
- 5.3** Demonstrate the proper procedure for calibration of a dose calibrator and state the acceptable limits for accuracy, constancy, linearity and geometry.



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**Unit 6 Radiopharmaceuticals**

**General Outcome:**

**6.0 The student shall be able to demonstrate an understanding of radiopharmaceuticals.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

**6.1 Define terminology associated with the understanding of radiopharmaceuticals:**

- a. radiopharmaceutical
- b. pharmaceutical
- c. radionuclide
- d. Curie (and associated units)
- e. Becquerel (and associated units)
- f. specific activity
- g. concentration
- h. toxicity, Pyrogenicity

**6.2 List step by step procedures for eluting a generator.**

**6.3 Given appropriate data, calculate generator or radiopharmaceutical activity that should be present at a given time.**

**6.4 Describe the physical and chemical properties of the following radionuclides:**

- a. technetium
- b. iodine
- c. xenon
- d. thallium
- e. gallium
- f. cobalt
- g. cesium

**6.5 Describe the procedure for preparation of radiopharmaceutical kits from Tc99m pertechnetate.**

**6.6 State NRC/HRS and FDA regulations governing the use of radiopharmaceuticals.**



**Unit 6 Radiopharmaceuticals continued**

- 6.7** In a clinical practice setting or laboratory exercise, complete the following tasks:
- a. elute a Mo99/Tc99m generator
  - b. perform quality control procedures on the generator eluate
  - c. assay the eluate
  - d. prepare sulfur colloid, MAA, and other Tc99m compounds from kits
  - e. perform all mathematical calculations needed to determine quantities to use in making kits and in preparing patient doses.
  - f. use sterile techniques throughout all steps of radiopharmaceutical preparation
  - g. maintain all required records.
  - h. use radiation safety techniques throughout all steps of the radiopharmaceutical preparation.
  - i. perform appropriate quality control procedures (chromatography) on all kit compounds.
  - j. given a request for a patient study, identify the appropriate radiopharmaceutical and calculate the patient dose.
  - k. utilize unit dose procedures to administer radiopharmaceuticals.
  - l. prepare the patient dose in a syringe using gloves, syringe shield and sterility techniques.



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**Unit 7 Survey Meter: Wipe Tests and Dept. Surveys**

**General Outcome:**

**7.0 The student shall be able to demonstrate an understanding of Nuclear Medicine Survey Meters.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 7.1** Outline specific quality control procedures for a scintillation counter to include the following:
  - a. window calibration
  - b. sensitivity
  - c. energy resolution
  - d. volumetric evaluation
  - e. chi-square determination
- 7.2** Given the appropriate information, determine the percent resolution from a FWHM calculation.
- 7.3** List and describe the function of each component of a NaI(Tl) scintillation detector.
- 7.4** Discuss the scintillation measuring techniques.
- 7.5** Describe the characteristics of scintillation detection crystals.
- 7.6** Given the necessary energy information, determine proper gain settings.
- 7.7** Discuss the use of scalers, timers, and rate meters in a scintillation detector.
- 7.8** Determine a statistically accurate counting rate for a radiation detector.
- 7.9** Define and differentiate between resolving time and dead time.
- 7.10** In a clinical setting of the BCC NM Laboratory complete the following:
  - a. calibrate the probe and well
  - b. record all required data
  - c. set-up for thyroid uptake
  - d. set-up for a bioassay
  - e. set-up for a schilling test
  - f. set-up for a wipe test
  - g. perform a chi-square test on the probe and well.



**Unit 8 Gamma Camera**

**General Outcome:**

**8.0 The student shall be able to demonstrate an understanding of Gamma Camera.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 8.1** Describe the function and use of the following components of the camera system:
  - a. detector assembly (collimators, crystal and photomultiplier tubes)
  - b. pulse height analyzer
  - c. operation controls
  - d. x, y circuitry
  - e. cathode ray tube (CRT) oscilloscope
  - f. multiformat imager
  - g. variable persistence scope
  - h. SPECT/whole-body imaging table
  - i. SPECT operation
- 8.2** Define the terms "field-uniformity", "sensitivity", "resolution", "linearity" and resolving time.
- 8.3** State the physical parameters and uses of low-energy, medium-energy, high resolution and pin-hole collimators.
- 8.4** Describe the method of window calibration (peaking-in) on a gamma camera.
- 8.5** Differentiate between spatial resolution and sensitivity, and describe the procedure for their determination.
- 8.6** Describe the effects of camera linearity, focus and astigmatism, and object to detector geometry on the image.
- 8.7** Compare and contrast intrinsic versus extrinsic quality control measurements on a gamma camera.
- 8.8** Compare acquisition parameters of SPECT imaging with those of planar imaging.
- 8.9** Discuss the basic designs and principles that enable the construction of tomographic images with the use of SPECT.



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## **Unit 8 Gamma Camera continued**

- 8.10** Identify special problems that occur when SPECT quality control procedures are performed, addressing specifically uniformity, linearity and center of rotation.
- 8.11** Outline the procedure for performing a center of rotation (COR) acquisition/reconstruction with a line source and/or point source



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**Unit 9 Quality Control**

**General Outcome:**

**9.0 The student shall be able to demonstrate an understanding of Quality Control.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 9.1** Define and use the terminology associated with quality control in the proper context
- 9.2** Identify the regulatory agencies that affect the practice of nuclear medicine, including specific regulations of the various agencies, the scope of their power, and enforcement considerations related to compliance versus noncompliance.
- 9.3** Outline a standardized record keeping system and discuss the rationale for each type of record, including patient records, employee records, radiopharmaceutical and instrumentation records.
- 9.4** Explain which parameters of a quality control program are recorded daily, weekly, monthly, quarterly, bi-annually, annually and give a rationale for the time factors
- 9.5** Discuss the function of various types of calibrated sealed sources.
- 9.6** Compare and contrast the use of the various types of flood sources and phantoms, stating the conditions for the use of each.



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**Unit 10 Computer Applications**

**General Outcome:**

**10.0 The student shall be able to demonstrate an understanding of Computer Applications.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 10.1** Define the following components of the computer:
  - a. input
  - b. memory
  - c. control
  - d. logic/arithmetic
  - e. output
- 10.2** Compare and contrast analog and digital computer systems and signals.
- 10.3** Define and/or describe decimal and binary number systems.
- 10.4** Define computer terminology such as bit, byte, word, etc.
- 10.5** Describe the organization and function of the central processing unit (CPU) of a computer.
- 10.6** Describe how information is stored in a computer memory, including various memory systems in the discussion.
- 10.7** State the factors that determine actual computer memory capacity.
- 10.8** Compare and contrast systems that operate as RAM versus ROM memory devices.
- 10.9** Define and describe the function of the ADC device.
- 10.10** Discuss buffers and "zoom" as they relate to nuclear medicine computers.
- 10.11** Discuss and explain the following acquisition modes of a computer:
  - a. static
  - b. dynamic
  - c. list
  - d. gated
- 10.12** Discuss the factors of reconstruction techniques such as time, space, frequency and filtering.
- 10.13** Discuss the environmental factors that affect a computer.



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**Unit 11 Clinical Procedures**

**General Outcome:**

**11.0 The student shall be able to demonstrate an understanding of clinic procedures.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 11.1** Discuss and explain the rationale for the following most common nuclear medicine procedures:
- a. bone scan
  - b. lung scan
  - c. liver-spleen scan
  - d. biliary scan
  - e. thyroid scan
  - f. renal scan
  - g. gallium scan
  - h. cardiac scans
- 11.2** Explain the following factors of each of the above nuclear medicine procedures:
- a. anatomy
  - b. physiology
  - c. clinical indications
  - d. radiopharmaceuticals used
  - e. protocol
  - f. patient preparation
  - g. equipment utilized
  - h. diagnosis
- 11.3** Discuss any factors and/or substances that may interfere with the performance of a valid test.
- 11.4** Discuss any contraindications or adverse reactions associated with the study.
- 11.5** Discuss possible alterations in the routine procedure, including order of views, drug administration, and effect of delay post dose administration on radiopharmaceutical distribution.
- 11.6** Identify normal and abnormal patterns of radiopharmaceutical distribution on typical studies.