CHATTANOOGA STATE COMMUNITY COLLEGE
DIVISION OF NURSING AND ALLIED HEALTH
COURSE SYLLABUS
NM 212 Nuclear Medicine Physics and Radiation Protection

Class Hours: 4 Credit Hours: 4
Instructor: Dusty York
Office hours are Monday through Friday from 1:00-4:00pm. Please call ahead to ensure that I will be in the office as clinic visits and meetings may conflict with this schedule.
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Catalog Course Description:
This course expands the student's understanding and application of the principles of physics and instrumentation as well as radiation biology as specifically related to nuclear medicine.

Topics include:
A continuation of imaging instrumentation, statistics in nuclear medicine, computers in nuclear medicine, principles of Single Photon Emission Computed Tomography, units of measurement; methods of measurements; the effects of statistical variation on measurements; protection from harmful effects of ionizing radiation; governing regulations in the use, handling, storage and disposal of radioactive materials; ALARA principles; and decontamination procedures.

Entry Level Standards:
The student must be a graduate of an accredited Radiologic Technology Program and/or be ARRT registered or ARRT eligible. Have a basic understanding of cell structure and function as well as basic mathematical skills.

Prerequisite:
Admission to the Nuclear Medicine Technology Program; NM200, NM201, NM205, Nm207, NM208

Corequisite(s):
NM 215, NM 217

Textbook(s) and Other Reference Material Basic to the Course:
1. Essentials of Nuclear Medicine Physics 2nd Edition; Rachel A. Powsner and Edward R. Powsner, Blackwell Science, 2006.
2. NUCLEAR MEDICINE TECHNOLOGY AND TECHNIQUES, 6th Edition. Paul E. Christian, Donald Bernier, and James K. Langlan, Mosby Book Publishers, 2007

I. STUDENT LEARNING OUTCOMES

The required competencies and student outcomes/instructional objectives in this course are utilized to meet the NMT Program overall mission to provide education and training experiences appropriate for the development of competent professional technologists in the use of radionuclides for diagnostic and therapeutic procedures. For more information on this, please see the NMT Program Student Handbook.

Institutional Student Learning Outcomes:
The knowledge, skills, and attitudes that a community college graduate is expected to have develop include:

ISLO1. Communication: Includes speaking, writing and graphic presentation skills

ISLO2. Critical Thinking: Purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual, considerations upon which that judgment is based.

ISLO3. Information and Technology Skills: Includes use of computers, online learning, information seeking, use of new technologies

ISLO4. Global/Cultural Awareness:: Includes awareness of how societal and cultural differences affect an individual's life, focusing on diversity and collaboration

ISLO5. Competency in a specialty: The specialty-specific competencies that each graduate of the program is expected to achieve

ISLO6. Work Ethic: Characteristic of teamwork, professionalism, integrity, and productivity.

Program Goals and Mission Statement

Mission Statement: Provide education and training experiences appropriate for the development of competent professional technologist in the use of radionuclides for diagnostic and therapeutic procedures.

Program Student Learning Outcomes Assessed in this Course: At the completion of the nuclear medicine technology program, the student will be prepared to perform the following. (See handbook for complete list of PSLO's.)

PSLO2: (Radiation Safety and Protection)

Apply as low as reasonably achievable philosophy (ALARA) to protect the patient, self, and others using knowledge of ionizing radiation, including interactions with the body and the biological effect of exposure in the performance of imaging and therapy, to perform all daily operations of the laboratory.

- CSLO5: Demonstrate a thorough understanding of the biological effects of radiation.
- CSLO6: Demonstrate a thorough understanding of radiation dosimetry.
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PSLO3: (Instrumentation Utilization and Quality Control)

Properly utilize imaging and non-imaging devices by performing acquisition and processing of patient studies, as well as perform and analyze all quality control procedures associated with the handling of radionuclides and imaging equipment.

- CSLO1: Demonstrate knowledge and understanding of the gamma camera imaging system.
- CSLO2: Demonstrate a thorough understanding of nuclear medicine statistics.
- CSLO3: Demonstrate a thorough understanding of Computers and their role in nuclear medicine.
- CSLO4: Demonstrate a thorough understanding of Single Photon Emission Computed Tomography (SPECT).
- CSLO7: Demonstate a thorough understanding of quality control procedures used on imaging and non-imaging equipment.

III. Indicators

1. Identify and describe various image acquisition modes.
2. List components of the imaging system.
3. Discuss roles of imaging parameters.
4. Define mode, matrix, and pixel size.
5. Demonstrate familiarity with basic statistics fundamentals used in nuclear medicine.
6. Define a statistical distribution and describe the various types used in nuclear medicine.
7. Define Chi-square.
8. Demonstrate efficiency in performing a Chi-square analysis.
9. Discuss the history of computers in nuclear medicine.
10. Define: Hardware, Software, RAM, ROM, PACS.

11. Discuss methods of data representation.
12. Describe proper care and quality assurance methods for maintaining computer systems in the nuclear medicine department.
13. Identify methods of acquisition when performing SPECT imaging.
14. Describe methods of image reconstruction.
15. Differentiate signal vs. noise in SPECT imaging.
16. Discuss various methods of filtering and how it affects SPECT images.
17. Identify characteristics of the most commonly utilized filters in nuclear medicine.
18. Differentiate between a high-pass and low-pass filter.
19. Describe various methods of attenuation correction.
20. Identify the areas of a cell.
21. Discuss the ionizing effects of radiation on the human body.
22. Define RAD and REM.
23. Be familiar with cell survival curves and what factors affect cell survival.
24. Differentiate stochastic and nonstochastic risks.
25. Differentiate physical, biological, and effective half-life.
26. Discuss radiation dose limits for the general public and occupational exposure
27. Describe methods for limiting radiation exposure.
28. Apply knowledge of system and component function to quality control outcomes to assess equipment performance.

III. Teaching/Learning Methods:

1. Class lectures / demonstrations

Class lectures will center around assigned reading material. A set of lecture notes with salient information will be distributed each week. These lecture notes are not all inclusive. Test material may be derived from any of the assigned reading material or from the lecture.

2. Reading assignments:

The student must be prepared for class. The reading assignments will be the basis for class discussions; therefore, the student must complete all reading assignments including handouts and notes before they are discussed in class.

3. Clinical assignments:

Clinical assignments are due on the final week of the semester. A complete set of instructions will be provided to each student.

4. Student presentations and projects

Presentations will be made on the final class meeting of the semester unless otherwise announced by the instructor.

IV. Instructional Activities

1. Image Acquisition Homework
2. Laboratory I: Scintillation Detector Instrumentation, Voltage Calibration to Determine Operating Voltage, and Evaluation of Radioactivity
3. Computer Homework
4. Statistics I Homework
5. Statistics II Homework
6. Laboratory II: Statistics,Chi Square, and Sensitivity
7. SPECT Part I Homework
8. Laboratory III: Pharmacy: Geometry, Accuracy, Linearity
9. SPECT Part II Homework
10. Laboratory IV: Kit Prep, HVL, Inverse Square Law, Radiation Regulations
11. SPECT Project

V. Assessments:

- Midterm: The Midterm exam covers course material from weeks 1-3. The exam consists of multiple choice questions. (CSLO 1,2,3)

- Laboratory Assignments: Laboratory assignments coincide with principles taught in NM 201 as well as NM 212. Laboratory is performed in small groups in a laboratory setting. (CSLO 1,2 Also prerequisite NM 201 concepts)
- Quizzes (Optional) (Quizzes may be given on any topic at any time)
- SPECT Project: The SPECT project is an individual project the student performs to gain a better understanding of SPECT imagin and processing parameters. See the SPECT project guidelines for a detailed description. (CSLO 4,7)
- Final Exam: A cumulative exam covering all material covered in this course. The exam consists of multiple choice questions. (CSLO 1, 2,3,4,5,6,7)

CSLO/Assessment Allignment:

CSLO	CSLO #1	CSLO #2	CSLO #3	CSLO #4	CSLO #5	CSLO #6	CSLO #7
Assessments	Midterm, Laboratory, Final exam	Midterm, Laboratory, Final exam	Midterm, Final exam	SPECT Project, Final exam	Final exam	Final exam	SPECT Project, Final exam

VI. Grading Scale

Grading Policy:
Grades will be based on objective tests consisting of registry type multiple choice questions as well as discussion questions. Clinical assignments as well as a quality control project will also contribute to the final grade. A score of 75 % will be the minimum for a passing grade in the course. The individual components will be weighted as follows:

Mid-term	35%
Laboratory Assignments	10%
Quizzes, Homework, and participation	5%
SPECT Project	10%
Final Exam	40%
TOTAL	100%

The grading scale is as follows:

90-100.....A
80-89.....B
70-79.....C
60-69.....D
59 and below...F

A score of less than 75% on any portion of the graded work may require the student to perform remediation work. This includes the final exam. Even if the student has a passing grade for the semester after failing to make a 75, the exam may require remediation. Only the first grade will count toward the student's final grade. Note a passing grade of 75 or greater is required to continue in the program.

VII.Schedule:

Classes will meet every other Tuesday from 9:00 am until 5:00pm of the Spring Semester unless otherwise specified by the instructor.

DATE TOPIC	REFERENCE
Week 1 (1/26)	
I. Review of Fall Semester	
Week 1 (1/26 continued)	
I. Imaging Instrumentation Lecture ○ Image Acquisition ○ mode ○ matrix ○ pixel size	1. (1) Chapter 6 Pg. 65-84
Week 2 (2/09)	
I. Statistics Lecture ○ Fundamentals ○ Distributions ○ Chi-square	1. (2) Chapter 1 pg.22-29
Lab	
I. Scintillation Detector Instrumentation II. Voltage Calibration to Determine Operating Voltage III. Evaluation of Radioactivity	
Week 3 (2/23)	
I. Computers Lecture ○ History ○ Hardware/Software ○ Image Acquisition ○ PACS	1. (2) Chapter 4
Lab	
I. Statistics II. Chi-square III. Sensitivity	
Week 4 (3/23)	
Midterm (Exam covers Weeks 1 – 3) I. SPECT Lecture II. Project Assigned	(1) Chapter 7 Pg. 85-113 (2) Chapter 9
Lab Group 1 / **Lab Group 2**	
. Pharmacy at TRIAD / Kit Preparation Laboratory II. Geometry, Accuracy, / HVL/Inverse Square Law III. Linearity, Constancy, etc. / Radiation Regulations	
Week 5 (4/8-4/11)) -	
I. Mandatory Attendance TSNMT Meeting in Chattanooga II. April 8-11	
Week 6 (4/20) Don Stone; Leesa Ross	
I. Biological Effects of Radiation Cell Structure • Cell Function	

• Ionizing Effect • Indirect Mechanism • Direct Mechanism • Linear and Threshold Effects II. Radiation Protection Standards and Internal Dose Considerations • Permissible dose equivalent • Radiation Protection Units	(1) Chapter 11 and 12. (2) Chapter 7
Lab	
Lab Group 2 — I. Pharmacy at TRIAD Laboratory II. Geometry, Accuracy, Law III. Linearity, Constancy, etc.	**Lab Group 1** — Kit Preparation HVL/Inverse Square Radiation Regulations
Week 7 (5/4)	
I. SPECT Project Presentations II. FINAL EXAM	

++++This schedule is subject to change.++++

In addition to the reading assignments listed, the student will also be given a series of handouts containing lecture notes, worksheets, diagrams, and published articles. The student is responsible for the material in these handouts. These handouts are not supplemental to the course content, they are essential components.

VIII. Instructor Policies:

The attendance policy will follow the Chattanooga State Technical Community College NM Program Handbook. Students are responsible for attending all class sessions. Any exceptions should be made prior to the missed class. The student is responsible for any information presented during their absence and make up work does not have to be assigned by the instructor. Beginning with the first infarction, a subtraction of 5 points from the final grade shall be made for a tardy and/or absence unless documentation is provided. The student is responsible for all material learned in class for testing purposes, even though that material was missed.

Plagiarism, cheating, assuming another student's identity, and other forms of academic dishonesty are prohibited and will result in immediate dismissal from the Program. Students guilty of academic misconduct, either directly or indirectly through participation or assistance, are immediately responsible to the instructor of the class. In addition to other possible disciplinary sanctions which may be imposed through the regular institutional procedures as a result of academic misconduct, the instructor will assign an "F" for the course, thus resulting in dismissal from the program.

If the student believes that he or she has been erroneously accused of academic misconduct, the student may appeal the case through the procedures described in the College Catalog.

The course will be evaluated to determine if the stated objectives are being achieved by monitoring each student's test results, final grades, class discussion and success rates on

national exams. The objectives of this course are based on the essential guidelines provided by the ARRT and NMTCB. The examinations reflect mastery of these objectives; and therefore, provide a reasonable means of determining whether the stated objectives are being met. If it is determined that the objectives are not being met, the course content will be altered to better meet the student's needs.

VIV. College Policies

This class is governed by the policies and procedures stated in the current Chattanooga State Student Handbook. This class is governed by the policies and procedures stated in the current Chattanooga State Student Handbook. Additional or more specific guidelines may be found in the NMT Program Student Handbook, as well as the Allied Health Student Handbook.. The instructor reserves the right to modify this syllabus in writing during the course of the semester

ADA Statement

Students who have educational, psychological, and/or physical disabilities may be eligible for accommodations that provide equal access to educational programs and activities at Chattanooga State. These students should notify the instructor immediately, and should contact Disabilities Support Services (Student Center, phone 697-4452) within the first two weeks of the semester in order to discuss individual needs. The student must provide documentation of the disability so that reasonable accommodations can be requested in a timely manner. All students are expected to fulfill essential course requirements in order to receive a passing grade in a class, with or without reasonable accommodations.

Disruptive Students

The term "classroom disruption" means behavior a reasonable person would view as substantially or repeatedly interfering with the activities of a class. A student who persists in disrupting a class will be directed by the faculty member to leave the classroom for the remainder of the class period. The student will be told the reason(s) for such action and given an opportunity to discuss the matter with the faculty member as soon as practicable. The faculty member will promptly consult with the division dean and the college judicial officer. If a disruption is serious and other reasonable measures have failed, the class may be adjourned and the campus police summoned. Unauthorized use of any electronic device constitutes a disturbance. Also, if a student is concerned about the conduct of another student, he or she should please see the teacher, department head, or division dean.

Affirmative Action

Students who feel that he or she has not received equal access to educational programming should contact the Affirmative Action Officer, at 697–4457.

Academic Integrity/Academic Honesty

In their academic activities, students are expected to maintain high standards of honesty and integrity. Academic dishonesty is prohibited. Such conduct includes, but is not limited to, an attempt by one or more students to use unauthorized information in the taking of an exam, to submit as one's own work, themes, reports, drawings, laboratory notes, computer programs, or other products prepared by another person, or to knowingly assist another student in obtaining our using unauthorized materials. Plagiarism, cheating, and other forms of academic dishonesty are prohibited. Students guilty of academic misconduct, either directly or indirectly through participation or assistance, are immediately responsible to the instructor of the class. In addition of other possible disciplinary sanctions, which may be imposed through the regular institutional procedures as a result of academic misconduct, the instructor has the authority to assign an "F" or zero for an activity or to assign an "F" for the course.

STUDENT ACKNOWLEDGEMENT STATEMENT

By my signature below, I attest that I have received and reviewed the NM 212, Nuclear Medicine Instrumentation, course syllabus.

I understand the course requirements with regard to attendance, grading, objectives, course policies and procedures, including those regarding my conduct in this course. I agree to be held accountable for my performance and actions according to such requirements and also agree to the provisions of the *Syllabus Guidelines Statement* as written within the course syllabus.

I am also aware of the credit hours and tuition costs associated with the enrollment into this course.

Student Name (Please Print):_____

Student Signature:_____ Date: _____