

**NUC 315: NUCLEAR MEDICINE INSTRUMENTATION &  
NUCLEAR MEDICINE INSTRUMENTATION LABORATORY**

University of Nevada, Las Vegas  
School of Health and Human Sciences  
Department of Health Physics

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**Credits:** 3 credits, lecture; 1 credit lab (separate syllabus)

**Prerequisites:** NUC 300 (or RAD 100) and NUC 350 (concurrently)

**Course Description:** Principles and application of radiation detection equipment and instrumentation employed in nuclear medicine procedures. Theory and laboratory application of quality control procedures specific to each instrument. Theory and laboratory application of imaging parameters.

**Course Goal:** To understand the functions, operations, limitations, and applications of the imaging and non-imaging radiation detection instruments used in the current practice of nuclear medicine, and to evaluate the performance of these instruments through the execution of appropriate quality control procedures.

**Course Objectives:** includes both lecture and laboratory

1. Show a general understanding of radioactive decay modes with special emphasis on those most appropriate for nuclear medicine detection and imaging instrumentation.
2. Compare and contrast the design, application, quality control procedures (QC) and limitations of the various types of gas detectors: Survey instruments (Geiger-Muller and Cutie Pie); exposure instruments (dosimeters); and dose determination instruments (dose calibrator).
3. Demonstrate the proper use of the gas detectors in the laboratory/clinical setting.
4. Accurately perform the mandatory quality control procedures for the dose calibrator: constancy; accuracy; linearity; geometric variation.
5. Describe and document acceptance criteria for each of the dose calibrator QC procedures.
6. Demonstrate an understanding of the centralized radiopharmacies' "dose/equipment tracking software."
7. Understand and demonstrate the principles of operation, the design and QC procedures for the non-imaging scintillation detectors (well-counter and uptake probe).
8. Understand the principles of operation and the design of the Anger (gamma) camera.
9. Compare and contrast the various collimators and explain their differences in terms of spatial resolution and sensitivity.
10. Examine, discuss, and describe the intrinsic and extrinsic planar performance characteristics of gamma cameras: uniformity; spatial resolution, linearity and distortion; energy resolution; sensitivity.
11. Examine, discuss, describe the performance characteristics specific to topographic (SPECT)

imaging.

12. Demonstrate competency and understanding of all QC procedures employed in planar and topographic imaging.
13. Demonstrate an understanding of the function and basic design of dedicated nuclear medicine computers, digital imaging systems, and other associated hardware..
14. Demonstrate an understanding of the acquisition, reconstruction and display parameters used in qualitative and quantitative image analysis.

**Teaching Methods:** Lecture, discussion, demonstration and laboratory format.

**Course Evaluation Methods:**

**Lecture:** There will be three examinations in the lecture component of this course: two during the semester and one comprehensive final. There will be no make-up examinations without a minimum of 24 hours **prior authorization**.

**Attendance in the classroom:**

Although attendance is not “graded,” during the lecture portion of this course, it is expected that you be present each day. Good attendance and class participation will be considered when the student is on the borderline for grading (e.g., if you have a grand total of 92% and have been present, attentive, and participated in class, you will probably receive an “A” instead of an “A-“). Please understand that “showing up for class” is not synonymous with “participation.”

**For my sake and the sake of other students, please be on time. It is extremely disruptive to all when you walk in late.**

**Grading:** Grading will be based upon the total points accumulated during the semester in the class and the laboratory (lecture will be worth 75% and the laboratory will account for the remaining 25%). A final letter grade will be assigned as a percentage of the total points according to the following scale:

<b>A = 93-100</b>	<b>C = 74-77</b>
<b>A- = 90-92</b>	<b>C- = 71-73</b>
<b>B+ = 87-89</b>	<b>D+ = 68-70</b>
<b>B = 84-86</b>	<b>D = 65-67</b>
<b>B- = 81-83</b>	<b>D- = 62-64</b>
<b>C+ = 78-80</b>	<b>F = 0-61</b>

**Please remember that your continuation in the nuclear medicine program depends on your adherence to the following: maintain a minimum of a 2.50 GPA each semester; have no negative grade points; and, receive a “C” or better in program courses (NUC, CMI, HPS, RAD).**

**Textbook:** Christian, P and Waterstram-Rich, K. Nuclear Medicine and PET/CT Technology and Techniques, 6<sup>th</sup> ed. Mosby Elsevier. 2012.

**Plus** handouts for both the lecture and lab.

**References:** Mettler F and Guiberteau M. Essentials of Nuclear Medicine Imaging, 5<sup>th</sup> ed. W.B Saunders Co. 2009.

Cherry, S, Sorenson, J and Phelps, M. Physics in Nuclear Medicine, 3<sup>rd</sup> ed. Saunders. 2008.

Powsner, R and Powsner, E. Essentials of Nuclear Medicine Physics. Blackwell Science. 2006.

Christian, P, Bernier, D and Langan, J. Nuclear Medicine and PET Technology and Techniques. M. 2008.

**If you have a documented disability that may require assistance, you will need to contact Disability Services (DS) for coordination in your academic accommodations. Disability Services is located within Learning Enhancement Services (LES), in the Reynolds Student Services Complex, Suite 137. The phone number is 895-0866 or TDD 895-0652.**

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### **NUC 315-Nuclear Medicine Instrumentation**

<b>Week 1</b>	Course Introduction; Basic Atomic and Nuclear Structure (Module 1)
<b>Week 2</b>	Labor Day Recess ( No school)
<b>Week 3</b>	Terms and Equipment Associated with Clinical Nuclear Medicine (Module 2); Gas radiation detectors; Principle of operation, use and calibration of ion chambers, Geiger-Müller (GM) counters, and proportional counters (Module 3)
<b>Week 4</b>	Quality control procedures of the dose calibrator (Module 3, continued).
<b>Week 5</b>	Non-imaging scintillation detectors: principles of operation, purpose, major components and types (Module 4); Personnel monitoring devices (Module 5)
<b>Week 6</b>	EXAM I
<b>Week 7</b>	Gamma spectrometry/pulse height analysis; energy resolution (FWHM) (Module 6). Statistics of counting (Module 7); Chi-Square test for scintillation detector reliability (Module 8); Efficiency of counting (Module 9)
<b>Week 8</b>	Scintillation camera: principles of operation; purpose; major components; types; collimator

characteristics (Module 10).

- Week 9** Quality control of the scintillation camera for planar imaging (Module 11); Uniformity and Linearity Correction (Module 12)
- Week 10** Image Properties (Module 13); Computer Acquisition of Images (Module 14).
- Week 11** **EXAM II**
- Week 12** Image Analysis, Enhancement and Image Display (Module 15). Single photon emission computed tomography (SPECT) fundamentals and image reconstruction (Module 16).
- Week 13** Module 16, continued; Quality control procedures in SPECT (Module 16).
- Week 14** Catch-up Day
- Week 15** Artifacts in SPECT (Module 17)
- Week 16** **Comprehensive Final**

## **UNIVERSITY POLICIES:**

**Academic Misconduct** – Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV’s function as an educational institution.

An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the Student Academic Misconduct Policy (approved December 9, 2005) located at:  
<http://studentconduct.unlv.edu/misconduct/policy.html>.

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Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at:  
<http://www.unlv.edu/provost/copyright>.

**Disability Resource Center (DRC)** – The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor before or after class to discuss your accommodation needs.

**Religious Holidays Policy** – Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor no later than the end of the first two weeks of classes, **September 22, 2015** of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit:  
<http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

**Incomplete Grades** - The grade of I – Incomplete – can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student’s control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester. If course requirements are not completed within the time indicated, a grade of F will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor

who assigned the I grade. Please note – Students cannot enroll in other nursing courses if they have an incomplete (I) in a course that is designated as a prerequisite to that course. (Per School of Nursing Policy C-12).

**Tutoring** – The Academic Success Center (ASC) provides tutoring and academic assistance for all UNLV students taking UNLV courses. Students are encouraged to stop by the ASC to learn more about subjects offered, tutoring times and other academic resources. The ASC is located across from the Student Services Complex (SSC). Students may learn more about tutoring services by calling 702- 895-3177 or visiting the tutoring web site at: <http://academicsuccess.unlv.edu/tutoring/>.

**UNLV Writing Center** – One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student’s Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>

**Rebelmail** – By policy, faculty and staff should e-mail students’ Rebelmail accounts only. Rebelmail is UNLV’s official e-mail system for students. It is one of the primary ways students receive official university communication such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. Students’ e-mail prefixes are listed on class rosters. The suffix is always [@unlv.nevada.edu](mailto:@unlv.nevada.edu). Emailing within WebCampus is acceptable.

**Library Resources** –Students may consult with a librarian ([www.library.unlv.edu/consultation](http://www.library.unlv.edu/consultation)) about research needs. For this class, the subject librarian is Xan Goodman. UNLV Libraries provides resources to support students’ access to information. Discovery, access, and use of information are vital skills for academic work and for successful post-college life. Access library resources and ask questions at [www.library.unlv.edu/](http://www.library.unlv.edu/)