

Applied Nuclear Physics

PHYS 4462 010 / 02Z

Fall 2019

MWF 8:00 - 8:50, VIN 147 / M 14:00 – 16:50, VIN 148

Instructor: Scott Williams (VIN 128)

Office Hours: MWF 9:00 – 10:00, MTRF 13:00 – 14:00, W 13:00 – 16:00, and by appointment

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Description: A study of the production and detection of radiation and its interaction with matter. Emphasis will be placed on nuclear radiation.

Required Texts: *Nuclear Physics: Principles and Applications* by John Lilley and *An Introduction to Error Analysis* by John Taylor

Student Learning Outcomes: Students will be introduced to three major study areas: The basic theory underlying nuclear radiations, the methods used to detect those radiations, and applications of those radiations. You will learn techniques that are used in current physics experiments, as well as medical and industrial processes. Applications to be studied will include diagnostic and therapeutic techniques in nuclear medicine, including computed tomography and magnetic resonance imaging, various spectrometry techniques, and the basics of fission and fusion power.

Assessment: Final grades will be based upon tests, homework assignments, reading quizzes, and laboratory exercises.

tests (4):	40%
comprehensive final test:	15%
homework and quizzes:	30%
laboratory exercises:	15%

Laboratory skills are assessed as a student learning outcome for program assessment in this course. Laboratory skills will be assessed using laboratory reports.

Policies: Reading assignments will be made at the end of class and are intended to help prepare students for the next lecture. *A commitment to reading is essential for success in the course.* Reading quizzes will be available through Blackboard and should be turned in through Blackboard. Absolutely no late reading quizzes will be accepted. Homework problems are intended to help students prepare for tests. Homework assignments are due by noon on the due date. If you are unable to physically hand in the assignment, you may e-mail the assignment to me, but it must still be turned in on-time for full credit. For every day the homework is late after the original due date, 25% will be deducted from the assignment's score. Laboratory reports are due at the beginning of the laboratory meeting that immediately follows the laboratory meeting in which the laboratory experiment was completed. Late laboratory reports will be accepted for a 2-day period following the original due date/time without a grade reduction. Tests may not be made up unless in the event of a university-excused absence, in which case it is the student's responsibility to schedule a time to make-up the missed test. Use of

electronic devices (telephones, computers, mp3 players) during lectures or tests is not allowed. All electronic devices should be turned off during class.

Accommodations: Persons with disabilities that may warrant academic accommodations must contact the Student Life Office, Room 112 University Center, in order to request and to implement academic accommodations. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence.

Academic Honesty: Angelo State University expects its students to maintain complete honesty and integrity in their academic pursuits. Students are responsible for understanding the Academic Honor Code, which is contained in both print and web versions of the Student Handbook.

Title IX: Angelo State University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from sex discrimination of any kind. In accordance with Title VII, Title IX, the Violence Against Women Act (VAWA), the Campus Sexual Violence Elimination Act (SaVE), and other federal and state laws, the University prohibits discrimination based on sex, which includes pregnancy, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination and unwelcome behavior of a sexual nature. The term includes sexual harassment, nonconsensual sexual contact, nonconsensual sexual intercourse, sexual assault, sexual exploitation, stalking, public indecency, interpersonal violence (domestic violence or dating violence), sexual violence, and any other misconduct based on sex. You are encouraged to report any incidents involving sexual misconduct to the Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator, Michelle Boone, J.D.

Religious Holy Days: A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence.

*The instructor reserves the right to modify/adjust any of the procedures, grading scales, and scheduling presented in this syllabus.

Lecture Schedule

08/26 – 08/30	Error Analysis (Taylor: chapters 5 & 11)
09/04 – 09/09	Introduction and Basic Concepts (Lilley: chapter 1)
09/11 – 09/16	Interaction of Radiation with Matter (Lilley: chapter 5)
09/16	Review
09/18	Test #1
09/20 – 09/27	Detectors and Instrumentation (Lilley: chapter 6)
09/27 – 10/04	Biological Effects of Radiation (Lilley: chapter 7)
10/04	Review
10/07	Test #2
10/09 – 10/16	Industrial and Analytical Applications (Lilley: chapter 8)
10/18 – 10/25	Nuclear Medicine (Lilley: chapter 9)
10/25	Review
10/28	Test #3
10/30 – 11/08	Power from Fission (Lilley: chapter 10)
11/11 – 11/20	Thermonuclear Fusion (Lilley: chapter 11)
11/20	Review
11/22	Test #4
11/25	Select Topics
12/02 – 12/06	Review
12/09	Comprehensive Final Test (8:00 – 10:00)

Laboratory Schedule

08/26	Counting Statistics
09/02	No Laboratory Meeting
09/09	Decay Chain Simulation
09/16	No Laboratory Meeting
09/23	No Laboratory Meeting
09/30	Gamma Ray Spectroscopy / Alpha Spectroscopy / Attenuation
10/07	No Laboratory Meeting
10/14	Gamma Ray Spectroscopy / Alpha Spectroscopy / Attenuation
10/21	Gamma Ray Spectroscopy / Alpha Spectroscopy / Attenuation
10/28	No Laboratory Meeting
11/04	Radiation Detector Instrumentation I
11/11	Radiation Detector Instrumentation II
11/18	No Laboratory Meeting
11/25	No Laboratory Meeting
12/02	No Laboratory Meeting