

PHYS4373 Nuclear Physics and Techniques**Semester: SPRING 2008****Department: Mathematics, Physics and Engineering****Credit Hours: 3****Required or Elective (circle one)****Current Catalog Description:**

The study of nuclear phenomena and properties including mass, stability, magnetic moment, radioactive decay processes and angular momentum. The use of nuclear techniques to analyze problems in other fields of engineering with a special emphasis on the characterization of electronic materials.

Course Schedule:

3 lecture hr/wk, 0 lab hr/wk

Textbook(s):

The Physics of Nuclei and Particles by Richard Dunlap, Thompson-Brooks/Cole Publishing, ISBN: 0-534-39294-6

Chart of the Nuclides by GE Nuclear Publishing (Reserved Reference in SCI219)

Handbook of Modern Ion Beam Analysis, 2nd Ed, by Tesmer, et. al., Materials Research Society, ISBN: 1-558-992545 (Reserved Reference in SCI219)

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Prerequisites by Topic:

PHYS3343 – Modern Physics I

Program Outcome and Course Learning Goals Map:

The Program Outcomes for Engineering Physics are:

- A. an ability to apply knowledge of math, engineering & science
- B. an ability to design and conduct experiments, as well as to analyze and interpret data
- C. an ability to design system, component or process to meet needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- D. an ability to function on multi-disciplinary teams
- E. an ability to identify, formulate, and solve engineering problems
- F. an understanding of professional and ethical responsibility
- G. an ability to communicate effectively
- H. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- I. a recognition of need for, and ability to engage in life-long learning
- J. a knowledge of contemporary issues
- K. an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
- L. a depth and breadth of knowledge in engineering and physics necessary to work in a multidisciplinary environment

Course Goals Upon completion of this course, students will	Program Outcome(s):
1. be able to describe experimental setups and results concerning the existence and basic properties of the nucleus including size, density, magnetic moment, etc.	A, L
2. be able to describe experimental evidence which contradicted the possible existence of electrons in the nucleus.	A, L
3. be able to apply nuclear models including liquid drop, Fermi gas, and shell model to solve problems including the calculation of nuclear binding energy, nuclear stability, and the spins and parities of nuclear ground states.	A, L
4. be able to apply nuclear energy level diagrams to solve problems involving alpha, gamma, and isobaric decay.	A, L
5. be able to apply nuclear reaction models and energy level diagrams to make simple nuclear reaction calculations including determining Q-values, threshold energies, and resonance energies.	A, L
6. be able to describe the equipment and working principles behind various accelerator systems and contrast their potential applications.	A, L
7. be able to describe various particle and photon detectors and contrast their characteristics (efficiency, cost, resolution, etc).	A, L
8. be able to list the various parts of a pulse height analysis system for both time and energy analysis and be able to describe the function of each component.	A, L
9. be able to calculate the attenuation of photons for various shielding materials and thicknesses using either tabulated data or computer simulation software.	A, L
10. be able to calculate the energy loss and straggling for a charged particle interacting with matter using either tabulated data or computer simulation software.	A, L
11. be able to describe the application of various nuclear physics based techniques to other areas of human endeavors including manufacturing, medicine, art, etc.	A, H, J, L
12. be able to apply nuclear physics concepts including elastic scattering and energy loss to determine the composition and thickness of thin films.	A, B, L
13. be able to describe the primary effects of ionizing radiation on biological tissue and be able to answer questions involving radiation safety.	A, H, J, L
14. be able to summarize the theoretical Rutherford scattering cross section's dependence upon the scattering angle, incident ion's energy and atomic number, and target atom's atomic number.	A, L
15. be able to analyze problems involving radioactive decay including determining half-life, disintegration constant, and activity.	A, H, J, L

Academic Honesty:

Cheating, plagiarism (submitting another person's materials or ideas as one's own), or doing work for another person who will receive academic credit are all-impermissible. This includes the use of unauthorized books, notebooks, or other sources in order to secure or give help during an examination, the unauthorized copying of examinations, assignments, reports, or term papers, or the presentation of unacknowledged material as if it were the student's own work. Disciplinary action may be taken beyond the academic discipline administered by the faculty member who teaches the course in which the cheating took place.

Students with Disabilities Policy:

It is the policy of Tarleton State University to comply with the Americans with Disabilities Act (ADA) and other federal, state, and local laws relative to the provision of disability services.

Students with disabilities attending Tarleton State University may contact the Office of Disability Services at (254) 968-9478 to request appropriate accommodation. Furthermore, formal accommodation requests cannot be made until the student has been officially admitted to Tarleton State University.

Contribution of Course to Meeting the Professional Requirement:

Math/Science Topics: 100%

Status of Continuous Improvement Review of this Course:

Prepared by: *Daniel K. Marble*

Date: 3/12/2008

Reviewed by: *Jim McCoy*

Date: 3/26/2008