

## PHY 413 – Nuclear Physics Syllabus

### Credit

4 semester hours

3 class hours of Lecture per week, 3 hours of Lab per week

### Prerequisite

PHY 301 or instructor's consent

### Catalog Course Description

Isotopes and nuclear structure, natural radioactivity, induced nuclear transformations, nuclear energy sources, high energy processes and cosmic rays.

### Rationale for Course

Physics is the study of the physical phenomena that we observe in our universe. It is broad ranging and essential to all the sciences. This course aims to introduce the fundamental concepts of physics, focusing primarily on the field of nuclear physics. Students will develop problem solving skills, learning how to logically approach and evaluate a variety of physical situations.

### Learning Objectives.

- The student will be able to identify and describe the nomenclature for labeling various nuclides.
- The student will be familiar with the theoretical basis for and applicability of the predominant nuclear models.
- The student will be able to understand radioactive decay processes, both natural and induced.
- The student will become familiar with applications of nuclear physics, their limitations and their possible extensions.
- The student will become familiar with basic nuclear experimental techniques and apparatus.

### Academic Integrity

Students are expected to be honest and to submit their own work on exams and research papers. Strict adherence to the Mississippi College "Honesty Policy" (*2009-2010 Mississippi College Undergraduate Bulletin, pg. 60*) will be followed.

### Course Outline

- History of nuclear physics
- Nuclear nomenclature
- Nuclear mass and binding energy
- Review/introduction of basic quantum mechanics concepts and calculations
- Radioactivity
- Basic nuclear structure
- Kinematics and dynamics of nuclear reactions
- Applications

### Method of Instruction

Classroom: Lecture and recitation, problem-solving demonstrations, experimental demonstrations  
Laboratory: Student investigation and reporting

### Required Text

*Introductory Nuclear Physics*, Krane, 1<sup>st</sup> edition, 1992, Wiley

### Laboratory Experiments

- Measurement apparatus
- Geiger counter and scintillator threshold voltage
- Multi-channel analyzer energy measurement
- Inverse-square distance law
- Absorption coefficients of lead and aluminum
- Radioactive decay, half-life
- Radioactive decay, transient equilibrium
- Single channel analyzer energy measurement (2 weeks)
- Compton energy measurement

### Grading

The final average will be computed as follows: 80% percent will be from *test points/total possible points*, 20% percent will be from lab grade. You MUST make at least a 75% in lab to pass the course. **A lab average of less than 75% will result in failure.**

Scale:	Grade	Final Average
	A	90-100
	B	80-89
	C	70-79
	D	60-69
	F	0-59

### Makeup Tests

Makeup tests will be given only under the following circumstances:

- Consent of the instructor has been obtained prior to the test.
- An excused absence is obtained from a doctor or the Vice-President for Academic Affairs

### Absences

Mississippi College policies on attendance and academic integrity will be enforced. Please see the *2009-2010 Mississippi College Undergraduate Bulletin*, pg. 56-57 for additional details of these policies. Students are responsible for all work missed during an absence.

### Special Needs

If you need special accommodations due to learning, physical, psychological, or other disabilities, please contact Dr. Buddy Wagner in the Counseling and Career Development Center. He may be reached by phone at 601-925-3354