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.

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, 1st 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 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

Dropping the Course

Refer to the Mississippi College Academic Calendar for the final drop date for the course. Drops after this date will only be permitted for extreme circumstances and will require approval from the course instructor, department chair, Dean of the School of Science and Mathematics, and the Vice-President for Academic Affairs.

Academic Integrity

Mississippi College students are expected to be scrupulously honest. Dishonesty, such as cheating or plagiarism, or furnishing false information, including forgery, alteration or misuse of University documents, records or identification, will be regarded as a serious offense subject to severe penalty, including, but not limited to, loss of credit and possible dismissal. See the *Mississippi College Student Handbook* or University Policy 2.19 for specific information regarding penalties associated with dishonest behavior at Mississippi College. Copies of the *Mississippi College Student Handbook* are available in the Office of the Vice President for Enrollment Management and Student Affairs, Nelson 313. Copies of University policies are available on the Mississippi College web site.

Attendance Policy

Class attendance/participation is an essential part of university education, and students are expected to

attend/participate regularly and punctually in all classes and laboratories. The responsibility for any work missed as the result of an absence rests entirely with the student. Cumulative absences/nonparticipation may result in a lowered grade or loss of credit for the course. Tardiness is also subject to penalty, as is any failure to complete required class work on time. A student will receive a grade of F immediately upon accumulating the following number of absences, whether excused or unexcused:

- 12 in semester classes meeting three times per week
- 8 in semester classes meeting two times per week

If a student misses more than the number of class periods specified in university policy and believes that there are reasonable explanations for the absences, he/she may appeal the absences to the Dean of the School of Science and Mathematics.

Early Alert System

Mississippi College has adopted the practice of finding students early in the semester who may be exhibiting behaviors that could ultimately have a negative impact on their academic progress. These behaviors are often called "red flag" behaviors and include, but are not limited to, excessive absences, poor test grades, and lack of class participation or evidence of non-engagement. Identifying these behaviors early gives the instructor the opportunity to raise the "red flag" on behalf of a particular student so that the student can take the appropriate action to redirect his/her progress. The system alerts the student, the student's advisor, and the Office of Student Success.

These messages are intended to help a student recognize an area of concern and to encourage him/her to make some choices to improve the situation. When a student receives an Early Alert message, the student should quickly make an appointment to talk with his/her professor about the situation. Also, students can make full use of the Office of Student Success to set academic goals and connect to campus resources.

Students with Disabilities

In order for a student to receive disability accommodations under Section 504 of the Americans with Disabilities Act, he or she must schedule an individual meeting with the Director of Student Counseling Services immediately upon recognition of their disability (if their disability is known they must come in before the semester begins or make an appointment immediately upon receipt of their syllabi for the new semester). The student must bring with them written documentation from a medical physician and/or licensed clinician that verifies their disability. If the student has received prior accommodations, they must bring written documentation of those accommodations (example Individualized Education Plan from the school system). Documentation must be current (within 3 years).

The student must meet with SCS face-to face and also attend two (2) additional follow up meetings (one mid semester before or after midterm examinations and the last one at the end of the semester). Please note that the student may also schedule additional meetings as needed for support through SCS as they work with their professor throughout the semester. Note: Students must come in each semester to complete their Individualized Accommodation Plan (example: MC student completes fall semester IAP plan and even if student is a continuing student for the spring semester they must come in again to complete their spring semester IAP plan).

Student Counseling Services is located on the 4th floor of Alumni Hall) or they may be contacted via email at mbryant@mc.edu . You may also reach them by phone at 601-925-7790. Dr. Morgan Bryant is director of MC Student Counseling Services.