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**Office Hours:** TR 1:00am-4:00pm or by appointment  
**Text:** Introductory Nuclear Physics, Kenneth S. Krane (John Wiley & Sons)

**Catalog Description:** PHYS 597 Nuclear Physics, 3 semester credit hours  
The study of nuclear phenomena and properties including mass, stability, magnetic moment, radioactive decay processes and nuclear reactions. The application of nuclear principles to other fields such as astronomy, engineering, manufacturing, and medicine.

### **Main Contents:**

- Introduction, units and useful constants
- The general properties of nuclei and nuclear matter: size, shape, density, composition and magnetic properties.
- Basic elements of quantum mechanics
- General properties of radioactivity and applications.
- Binding energy, liquid drop model and the semi-empirical mass formula.
- The strong force between nucleons and the nuclear equation of state
- Nuclear instability and decay: alpha, beta and gamma decay of nuclei.
- Nuclear spectroscopy and microscopic models: Shell model and collective models
- Nuclear reactions: kinematics and cross sections, Coulomb scattering, nuclear scattering, direct and indirect reactions, fusion and fission, relativistic heavy-ion collisions and radioactive beams induced reactions.
- Meson physics: properties of pions and kaons, meson and baryon resonances.

### **Student Learning Outcomes:**

- 1.** Students will have a clear understanding of basic properties of nuclei
- 2.** Students will understand radioactivity and decay law of unstable nuclei
- 3.** Students will have a good grasp of the physics origin of each term in the atomic mass formula and calculation of binding energy
- 4.** Students will understand the main features of nuclear force and its microscopic origin
- 5.** Students will understand the main features of alpha, beta and gamma decay modes
- 6.** Students will understand properties of hydrogen-like atoms using three-dimensional quantum mechanics
- 7.** Students will have a basic understanding of single-particle motion of nucleons and collective modes of nuclei
- 8.** Students will have a good grasp of basic concept and techniques of nuclear reactions and meson theory

### Grading:

Home works	30%
Research paper*	20%
Exams	50%

\*After discussions with each student about his/her background, interest and career goals, the instructor will assign a mini-research project for the student to carry out. The student is required to update the instructor his/her progress every other week during the office hours. Before the end of the semester, each student is required to submit a 5-10 page research report to turnitin.com and the report will be graded by the instructor. The student, the instructor and the university co-share the intellectual property of the research products contained in the research paper.

### Grade Scale:

90 and above	--	A
80 to 90	--	B
70 to 80	--	C
60 to 70	--	D
below 60	--	F

### Homework:

Homework will be assigned regularly and it may be discussed in class. The homework counts 40% towards the final grade. **Students must do their own homework while discussions with others are strongly encouraged.**

### Exams:

There are totally three exams with equal weight, and they all will have an in-class component. At the instructor's discretion, a take-home component may also be assigned in order to test the students on more difficult or time-consuming problems. **Students must do their own work on any take-home components of exams.** The exact dates of the exams will be announced in class at least 1 week before each exam.

### Cheating, Plagiarism, and other Breaches of Academic Conduct:

Academic cheating, plagiarism, and other forms of academic misconduct may result in removal of the student from class with a failing grade or may in extreme cases result in suspension or expulsion from the University as described in the "Code of Student Conduct" section of the *Student's Guidebook*.

### Classroom Behavior:

Disorderly conduct which interferes with the normal classroom atmosphere will not be tolerated. The classroom instructor is the judge of such behavior and may instruct a disorderly student to leave the room with an unexcused absence or, in more serious

situations, a student may be removed from the class with a failing grade. **All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. (See Student's Guide Handbook, Policies and Procedures, Conduct). A&M-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.**

### **Attendance and Tardiness:**

*Students are expected to be on-time and present for all class meetings.* Excused absences can be arranged prior to the class period being missed for appropriate activities as determined by the instructor. If an **emergency** results in an absence, the student should contact the instructor **as soon as possible** informing the instructor of the emergency and inquiring about ways to make up the missed class. The instructor will make judgments on how to handle the situation. Possible reasons for an excused absence are listed in the *Student's Guidebook* under class attendance policy. A student who is tardy at the time roll is called may be marked absent.

### **ADA Eligible Students:**

ADA eligible students should make arrangements with the instructor in the first week of the semester about special arrangements needed for classroom or testing facilities and procedures to accommodate the disability.

### **Evaluation of Instruction:**

Students will be given opportunities to evaluate instruction near the end of the semester. The physics department utilizes a scantron-graded questionnaire with statements regarding various elements of instruction and in addition utilizes an open-ended form where students can make comments on all elements of the classroom. These comments are given to the instructor and department head soon after the grades are recorded. If students have concerns about the classroom experience during the semester they should inform the instructor of those concerns and failing a satisfactory response may, as a last resort, contact the physics department head with those concerns.