PHYS 4337 – Nuclear Physics
PENS Department and the Texas Physics Consortium
Spring 2019

A. COURSE INFORMATION

Course number/section: PHYS 4337.301
Class meeting time: MWF 10:00AM-10:50AM
Class location: CCH 221, TTVN Video Classroom
Course Websites: http://wtclass.wtamu.edu/

B. INSTRUCTOR INFORMATION

Instructor: Dr. Hisham Albataineh
Office location: TAMU-Kingsville, H208
Office hours: TBA
Telephone: 361-593-2426
E-mail: hisham.albataineh@tamuk.edu
Appointments: Appointments outside of the office hours should be scheduled via email.

Local Instructor: Dr. Barbara Szczerbinska
Office location: NRC 3503
Office hours: Tuesday 8:15AM-9:15AM, 2PM-3PM
           Wednesday 9AM-11AM
           Thursday 8:15AM-9:15AM, 2PM-3PM
Telephone: (361) 825-3916
E-mail: Barbara.Szczerbinska@tamucc.edu
Appointments: Appointments outside of the office hours should be scheduled via email.

C. COURSE DESCRIPTION

Catalog Course Description
The study of nuclear phenomena and properties including mass, stability, magnetic moment, radioactive decay
processes and angular momentum. The use of nuclear techniques as applied to other scientific fields including
electronics and medicine.

Extended Course Description
This course is being offered by the Texas Physics Consortium as part of the Joint BS degree with a Physics
Major. All TPC courses use the WTClass system for class management (instead of Blackboard). For more
information on TPC, please visit our website (http://www.tarleton.edu/tpc/) or speak with the Local
Facilitator.

The Course Syllabus from the sending institution will be provided for students and will be the primary
Syllabus that the instructor will follow. This Syllabus exists to make sure you have all of the information
summarized in one place and that you are informed about TAMUCC policies.
D. **PREREQUISITES AND COREQUISITES**

**Prerequisites:**
PHYS 3334 – Modern Physics I

**Co-requisites:**
- PHYS 4335 – Quantum Physics I
- MATH 3315 – Differential Equations or MATH 3470 – Calculus III

E. **REQUIRED TEXTBOOK, READINGS AND SUPPLIES**

**Required Textbook:**
Introduction to Nuclear & particle Physics by Das & Ferbel
World Scientific Publishing
ISBN: 978-9812-387448

**Optional Textbook:**
Introductory Nuclear Physics by Kenneth Krane
Wiley
ISBN: 978-0471-805533

**Other Optional Textbooks:**
Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles by Eisberg & Resnick (Optional)
Subatomic Physics by Frauenfelder, Hans, Hanley, Ernest M. (Optional)

**Reference Materials:**
The Physics of Nuclei & Particles by Richard Dunlap
All Things Nuclear by James C. Warf
The Handbook of Modern Ion Beam Materials Analysis by Nastasi, et. al.
Nuclear Physics and Applications by Libby
Particle Accelerators by Livingston & Blewett
Particle Accelerators & Their Uses: Vol 1 & 2 by W. Scharf
Ion Beam Techniques in Archaeology and the Arts by J. Bird, etc. al.
Fundamentals of Surface and Thin Film Analysis by Feldman & Mayer
Introduction to High Energy Physics by Perkins
Chart of the Nuclides 16th Edition by Lockheed Martin

**Supplies:**
- Internet access is vital for interacting with the instructor and the local facilitator.
- Access to a scanner may be required to submit homework assignments. The Local Facilitator can help with this.

F. **STUDENT LEARNING OUTCOMES AND ASSESSMENT**

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.
Course Objectives (Specific learning objectives will be shared by the instructor in the Syllabus and during Class.)

1. be able to describe experimental setups and results concerning the existence and basic properties of the nucleus including size, density, magnetic moment, etc.
2. be able to describe experimental evidence which contradicted the possible existence of electrons in the nucleus.
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.
4. be able to apply nuclear energy level diagrams to solve problems involving alpha, gamma, and isobaric decay.
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.
6. be able to describe the various accelerator systems and their subcomponents including ion sources, vacuum pumps, optics, and analyzing magnets and contrast the accelerator system’s potential applications.
7. be able to describe various particle and photon detectors and contrast their characteristics (efficiency, cost, resolution, etc.).
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.
9. be able to calculate the attenuation of photons for various shielding materials and thicknesses using either tabulated data or computer simulation software.
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.
11. be able to describe the application of nuclear physics principles and instrumentation to other fields such as astrophysics, nuclear engineering, materials characterization, and medicine.
12. be able to apply nuclear physics concepts including elastic scattering and energy loss to determine the composition and thickness of thin films.
13. be able to describe the primary effects of ionizing radiation on biological tissue and be able to answer questions involving radiation safety.
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.
15. be able to analyze problems involving radioactive decay including determining half-life, disintegration constant, and activity.

G. INSTRUCTIONAL METHODS AND ACTIVITIES
Classes will be held via live video conference among all of the Texas Physics Consortium schools. Students will be able to ask questions during class, and the instructor will see who is asking the question.

H. MAJOR COURSE REQUIREMENTS AND GRADING
Course requirements and grading will be discussed by the instructor during the first class.

According to TAMU-CC Final Examination schedule, the final exam for this course will take place on May 3rd, 2018 at 08:00AM-10:30AM

I. COURSE CONTENT/SCHEDULE
The expected content and schedule will be distributed by the instructor during the first class. Please, visit [http://wtclass.wtamu.edu/](http://wtclass.wtamu.edu/) for more details.

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning

J. COURSE POLICIES

The course instructor will discuss specific course policies during the first class.

K. COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. **Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course.** Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar ([http://www.tamucc.edu/academics/calendar/](http://www.tamucc.edu/academics/calendar/)) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116. If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816. http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

- **Academic Calendar**

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<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>January 14</td>
<td>Classes begin</td>
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<tr>
<td>January 21</td>
<td>Martin Luther King, Jr. Holiday</td>
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<tr>
<td>January 22</td>
<td>Last day to register or add a class</td>
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<tr>
<td>February 26</td>
<td>Last day to apply for Spring graduation</td>
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<tr>
<td>Date</td>
<td>Event</td>
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<tr>
<td>March 11-15</td>
<td>Spring Break</td>
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<tr>
<td>April 5</td>
<td>Last day to drop a class</td>
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<td>April 30</td>
<td>Last day to withdraw from the University</td>
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<tr>
<td>May 1</td>
<td>Last day of classes</td>
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<td>May 2</td>
<td>Reading Day</td>
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<td>May 3, 6-9</td>
<td>Final examinations</td>
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<td>May 11-14</td>
<td>Grading days</td>
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<td>May 11</td>
<td>Spring Commencement</td>
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<tr>
<td>May 14</td>
<td>Spring grades due</td>
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M. GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.