

## **PHYS3343 Modern Physics I Writing Intensive Course**

### **Current Catalog Description:**

Foundations of the atomic theory of matter; structure; atomic spectra and energy levels; quantum theory of radiation; x-rays; special theory of relativity.

### **Course Schedule:**

3 lecture hr/wk, 2 lab hr/wk

### **Prerequisites by Topic:**

PHYS2424 – Principles of Physics II

MATH333 – Calculus 3

### **Detailed Course Description:**

PHYS334 is a junior level course for students majoring in engineering and physics. The course builds upon the student's past course work in PHYS122 and PHYS242 and introduces the student to the revolutions in physics that occurred in the late 19<sup>th</sup> and 20<sup>th</sup> Century including Relativity and Quantum Mechanics. The construction of Modern Physics grew from the inability of Classical Physics to explain the results of experiments involving high speed objects including light and experiments involving the macroscopic world. These experimental results are often counter intuitive to a student's everyday experiences. Thus, a student needs to acquire an understanding of the concepts that govern modern physics, perform experiments to develop an experience base to guide their application of these concepts as well as solid mathematical foundation to perform the necessary calculations. Finally, the student must work to develop the communication skills (verbal and written) necessary for a professional physicist or engineer to present their experimental results to a technical audience.

### **Lab:**

During the semester, the student will perform a series of famous experiments whose results run counter to the expectations of Classical Physics. For each experiment, the student will be required to either make a 12 minute oral presentation or a contributed poster presentation in American Physical Society (APS) conference format. The student will also be required to write up at least three experiments as if publishing the work in an American Institute of Physics Journal (AIP format). All lab assignments must be successfully completed at a C level or better for the student to pass the course.

### **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

<b>Course Goals</b> Upon completion of this course, students will	<b>Program Outcome(s):</b>
1. be able to state the postulates of the special theory of relativity and solve problems involving time dilation, length contraction, relativistic energy and momentum.	A, L
2. be able describe the experimental setup and results of important experiments and observations that led to the development of modern physics along with the predictions of classical physics. Be able to solve problems related to these experiments.	A, L
3. be able to explain qualitatively the meaning of various quantum concepts including expectation value, wave function, uncertainty principle, wave-particle duality, and Bohr correspondence principle. Be able to solve problems related to these concepts	A, L
4. be able to state the assumptions behind the Bohr model and be able to apply the model to calculate the predicted energy levels of single electron atom systems.	A, L
5. be able to apply the Schrodinger equation to analyze simple 1-D problems including infinite and finite square wells, quantum harmonic oscillator, finite barriers, and the hydrogen atom.	A, G, L
6. be able to explain the meaning of spatial quantization and be able to solve problems related to the electron energy level correction for an atom in a magnetic field.	A, G, 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 of 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.

**Reviewed by:** Shaukat Goderya

**Date:** March 12, 2008

**Review notes:**

Added sentences in the course goals

**Reviewed by:** Jim McCoy and Daniel Marble

**Date:** May 18, 2008