



## Alabama Department of Postsecondary Education

*Representing Alabama's Public Two-Year College System*

*Jefferson State Community College*

### PHY 214S General Physics with Calculus II

- I. **PHY 214 General Physics with Calculus II - 4 Semester Hours**  
Core Area III, ASCI TSCI (Lec 3 hrs, Lab 2 hrs)
- II. **Course Description**  
This course provides a calculus-based study in classical physics. Topics included are simple harmonic motion, waves, sound, light, optics, electricity, and magnetism. Lab is required.
- III. **Prerequisite**  
PHY 213
- IV. **Textbook**  
**Physics for Scientist & Engineers, 9<sup>th</sup> edition, Serway & Jewett,** publisher  
Brooks/Cole, Cengage
- V. **Course Objectives**  
To promote an understanding of the basic content of oscillations, waves, sound, electricity and light
  - A. To provide the student with the opportunity to develop problem solving skills
  - C. To provide the student with the background material necessary for entry into the engineering fields
  - D. To provide the student with basic laboratory skills
- VI. **Course Content**
  - A. Mechanics of solids and fluids
    1. States of matter
    2. Density and pressure
    3. Archimedes' principle
    4. Bernoulli's equation
  - B. Wave motion
    1. Reflection and transmission
    2. Sound waves

3. Light
4. Interference, reflection, and refraction
- c. Electricity and magnetism
  1. Static electricity
  2. Gauss's Law
  3. Electric Potential
  4. Capacitance and Resistance
  5. Electric current, DC Circuits
  6. Magnetic fields and their source
  7. Farady's Law and inductance

## **VII. General Course Competencies**

- A. The student will acquire understanding of simple harmonic motion.
- B. The student will acquire understanding of certain properties of solids and fluids such as stress, strain, Young's modulus, Pascal's principle and Archimedes' principle.
- C. The student will acquire understanding of the electric forces, fields, and potentials associated with various charge distributions using calculus when appropriate.
- D. The student will understand what is meant by capacitance and be able to analyze circuits involving capacitors in series and in parallel.
- E. The student will understand what is meant by current, resistance, and potential difference and be able to analyze d.c. circuits involving resistors in series and in parallel.
- F. The student will understand the principles of electro-magnetic induction.
- G. The student will understand the electromagnetic spectrum and laws of optics.
- H. The student will demonstrate an understanding of the techniques required to observe carefully and to measure precisely.
- I. The student will develop skills in reasoning logically and reporting results concisely from the data obtained.
- J. The student will be able to apply the techniques required to understand physical laws and principles by actual experimentation.
- K. The student will demonstrate an ability to use the basic tools of measurements as applied to distance, time, mass, current, and light.
- L. The student will be able to apply the techniques of collecting and analyzing experimental data, including graphic and statistical analysis.

## **VIII. Course Objectives Stated In Performance Terms**

- A. The student will acquire understanding of simple harmonic motion. The student will be able to:
  1. Define the following quantities related to simple harmonic motion: cycle; period; frequency; coordinate; and amplitude.
  2. Given the form of restoring force acting on an object, determine the equations of motion of the object.
- B. The student will acquire understanding of certain properties of solids and fluids such as stress, strain, Young's modulus, Pascal's principle and Archimedes' principle. The student will be able to:
  5. Define stress, strain and Young's modulus.
  2. Define and apply the concept of hydrostatic pressure.
  3. State and apply Pascal's principle.
 State and apply Archimedes' principle.
- C. The student will understand the electromagnetic spectrum and the laws of optics. The student will be able to:
  1. Define wavelength, frequency, amplitude, Hertz, Angstrom, wave velocity, and period.

- State the speed of light in a vacuum.  
Relate the speed of light to wavelength and frequency.
4. State and apply the laws of reflection and refraction to appropriate problems.
  5. Be able to relate the speed of light in a medium to the index of refraction.
- D. The student will demonstrate an understanding of the techniques required to observe carefully and to measure precisely. The student will be able to:  
Demonstrate correct graphing techniques.
2. Apply Hooke's law and to relate this law to simple harmonic motion, both linear and rotational.
- Trace light rays reflected from and refracted by various surfaces.
- E. The student will develop skills in reasoning logically and reporting results concisely from the data obtained. The student will be able to:  
Construct a graph on the appropriate scales including units, clearly indicating data points and drawing the best fitting curve.
2. Demonstrate the technique for presenting and analyzing data by the submission of well written laboratory reports. The student will include as a minimum:
    - (1) Data in a neat and clearly presented form
    - (2) Graphs (where appropriate)
    - (3) Sample calculations
    - (d) Analysis--the student will discuss the results obtained from his/her collected data, comparing these to the theoretical relationships. In all cases, the student will explain any discrepancies between experimentally derived results and theoretical expectations.
- F. The student will be able to apply the techniques required to understand physical laws and principles by actual experimentation. The student will be able to:
1. Apply the principles of wave theory to find the speed of sound in air.
  2. Describe the laws of reflection and refraction.
  3. Calculate the index of refraction of transparent media.
  4. Apply the equations for lenses and curved mirrors for the calculation of focal length and to describe the images formed by these surfaces for various object distances.
  5. Demonstrate facility in the use of the apparatus by collecting and tabulating data to obtain results within 10% of the accepted standards.
  6. Demonstrate the correct use of voltmeters, ammeters, and galvanometers.
  7. Demonstrate the correct set up for null devices and to use these devices correctly.
  8. The student will be able to use the oscilloscope to determine voltages and frequencies.
- G. The student will acquire understanding of the electric forces, fields, and potentials associated with various charge distributions using calculus when appropriate. The student will be able to:
1. Relate the force on a charged particle to the applied electric field.
  2. Derive the electric field for a distribution of charges both discrete and continuous using calculus when appropriate.
  3. State and apply Gauss's law.
  4. Find the electric potential and electric potential energy for electrical charge distributions.
  5. Relate the work done on a charge to the electric field in that region.
  6. Relate the potential difference between two points to the electric field in that region.
- H. The student will understand what is meant by capacitance and be able to analyze circuits involving capacitors in series and in parallel. The student will be able to:

1. Define capacitance.
  2. Calculate the capacitance for various charge distributions.
  3. Analyze circuits involving capacitors in series and parallel.
- I. The student will understand what is meant by current, resistance, and potential difference and be able to analyze d.c. circuits involving resistors in series and in parallel. The student will be able to:
1. Define current and current density.
  2. Relate resistance and resistivity to temperature.
  3. State and apply Ohm's law.
  4. State and apply Kirchoff's laws.
  5. Analyze d.c. circuits involving resistors in series and in parallel.
- J. The student will understand the principles of electro-magnetic induction. The student will be able to:
1. State and apply Faraday's law and Lenz's law for the emf induced in a conductor due to changing magnetic flux.
  2. Define a transformer and solve problems relating voltage, current, and the number of turns ratio.
  3. Define the self-inductance for various current-carrying elements.
  4. Relate the induced emf to inductance and the rate of change of the current.
- K. The student will demonstrate an ability to use the basic tools of measurements as applied to distance, time, mass, current and potential difference, and light. The student will be able to:
1. Demonstrate facility in the use of the apparatus by collecting and tabulating data to obtain results within 10% of the accepted standards.
- L. The student will be able to apply the techniques of collecting and analyzing experimental data, including graphic and statistical analysis. The student will be able to:
1. Correctly interpret these graphs and where possible give the algebraic equation derived from the graphs.
  2. Produce the mathematical relations and the physical constants from the graphs of the data.
  3. Demonstrate the technique for presenting and analyzing data by the submission of well written laboratory reports.

## **IX. Class Activities**

- A. Lecture
- B. Discussion
- C. Experimentation
- D. Demonstrations
- E. Written examinations

## **X. Evaluation and Assessment**

Specific information on how grade is determined to be included.

Grades will be given based upon A = 90 – 100%, B = 80 – 89%, C = 70 – 79%, D = 60 – 69%, and F = below 60%.

## **XI. Attendance**

Students are expected to attend all classes for which they are registered. Students who are unable to attend class regularly, regardless of the reason or circumstance, should withdraw from that class before poor attendance interferes with the student's ability to achieve the objectives required in the course. Withdrawal from class can affect eligibility for federal financial aid.

## **XII. Statement on Discrimination/Harassment**

The College and the Alabama State Board of Education are committed to providing both employment and educational environments free of harassment or discrimination related to an individual's race, color, gender, religion, national origin, age, or disability. Such harassment is a violation of State Board of Education policy. Any practice or behavior that constitutes harassment or discrimination will not be tolerated.

## **XIII. Americans with Disabilities**

The Rehabilitation Act of 1973 (Section 504) and the Americans with Disabilities Act of 1990 state that qualified students with disabilities who meet the essential functions and academic requirements are entitled to reasonable accommodations. It is the student's responsibility to provide appropriate disability documentation to the College. The ADA Accommodations office is located in FSC 300 (205-856-7731).