COURSE OUTLINE

Course Number	Course Title	Credits
PHY 102	**College Physics II**	**4**

Hours: Lecture/Lab/Other	Pre-requisite	Implementation
3/3/0	PHY 101	**Fall 2022**

Catalog description:
The second semester of an algebra-based two-semester physics sequence. Topics include electricity, magnetism, optics, atomic physics and nuclear physics. The laws of physics are investigated and applied to problem solving.
3 lecture/3 laboratory hours

General Education Category:
Goal 3: Science

Course coordinator:
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Required texts & Other materials:

College Physics, volume 2
10th edition
Serway & Vuille
Cengage
ISBN: 978-1285737041

Physics 102 Laboratory
Jing Huang
MCCC Book Store

Scientific Calculator

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. demonstrate understanding of the physics concepts, laws, and principles [Supports ILG #3; PLO #1]
2. Solve theoretical problems by applying physics concepts, laws, and principles. [Supports ILG #2, #3, #10, and #11; PLO #2]
3. Solve laboratory problems by applying their knowledge and experience with modern equipment. [Supports ILG #3, #4, and #11; PLO #3]
4. Demonstrate their knowledge and experience with modern equipment. [Supports ILG #3, #4; PLO #4]
5. Demonstrate ability to communicate effectively [Supports ILG#1, #3, and #4; PLO #5]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.
Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Physics (PLO)

1. Students are expected to develop a framework of knowledge, including concepts, laws, and principles
2. Students are expected to develop problem-solving skills for theoretical problems
3. Students are expected to develop hands-on problem-solving skills
4. Students are expected to develop hands-on experience with modern laboratory equipment
5. Students are expected to develop teamwork and communication skills

Units of study in detail – Unit Student Learning Outcomes:

Unit I [Electricity] [Supports Course SLOs #1, #2, #3, #4, #5]

Learning Objectives
The student will be able to:

- understand charges, electric field, equipotential surface, and Columb's Law
- understand current, voltage, resistance, and Ohm's Law
- understand DC and AC circuits.
- understand capacitance and relation to voltage and power
- understand electric field and the relation to charge distribution
- improve problem solving skills by reading word problems and applying basic concepts.
- solve problems involving vectors.
- solve problems in the laboratory

Unit II [Electricity and Magnetism] [Supports Course SLOs #1, #2, #3, #4, #5]

Learning Objectives
The student will be able to:

- understand magnetic field, magnetic force, and the relation with current.
- understand induced voltage
- understand energy in magnetic field
- solve problems involving vectors.
- solve problems in the laboratory

Unit III [Optics] [Supports Course SLOs #1, #2, #3, #4, #5]

Learning Objectives
The student will be able to:

- reinforce knowledge on vector reflection, refraction, and total internal refraction.
- reinforce problem solving in mirrors and lenses.
- understand the basic concepts involved interference, diffraction, and polarization.
- reinforce concepts through solving problems.

Unit IV [Atomic and Nuclear Physics] [Supports Course SLOs #1, #2, #3, #4, #5]

Learning Objectives
The student will be able to:

- relate atomic spectrum to energy levels
- Understand nuclear radiation types, alpha, beta, and gamma.
- solve problem using radiation half-life
- understand environmental safety
- understand nuclear reaction and power plants
- measure and calculate radiation properties

Laboratory experiments [Supports Course SLOs #3, #4, #5]

1. Math overview & lab introduction, circuits diagram and circuit construction

   - Go over arithmetic and algebra required by solving problems
   - Learn to graph using Excel
   - Establish laboratory safety rules.
   - Learn about lab report rules

2. The electric field and equipotential surface

   - Learn to draw electric field diagram of isolated charge, parallel plates, and pair of point charges
   - Learn to construct a circuit for measuring electric potential of a grid
   - Learn to measure and record electric potential of a grid using a voltmeter

3. Circuits & Capacitance

   - Learn to identify basic circuit elements in circuit diagram
   - Learn to construct simple circuits with lab equipment
   - Always use a circuit breaker for safety and conservation of energy
   - Use capacitor meter to measure isolated capacitance
   - Use capacitor meter to measure capacitors connected in series or parallel
   - Use capacitor meter to study the relationship between capacitance and plate separation
   - Use Excel to graph the capacitance and plate separation relationship
   - Use Excel to analyze the relationship between capacitance and plate separation

4. Automated Data Acquisition & Ohm's law

   - Introduce computerized data acquisition
   - Introduce data acquisition controller, sensor, and software
   - Ammeter and voltmeter measurements
   - Data acquisition and analysis

5. Wheatstone bridge

- Learn to read multi-loop circuit diagram
- Learn to construct multi-loop circuits
- Learn to analyze circuits
- Learn to use Galvanometer, move slider, and find zero balance

6. Earth's magnetic field

    - Learn about earth's magnetic field
    - Research the magnitude and direction of the earth's magnetic field at the location of the lab
    - Learn to orient the compass so that the magnetic field generated by the wire loops will be perpendicular to the natural magnetic field of the earth on the horizontal surface
    - For the center of the wire loop, calculate the magnitude of the magnetic field

7. Induced voltage and magnetic field of a solenoid

        - Use voltage sensor
        - Measure the induced voltage
        - Drop a bar magnet and let it fall through a solenoid
        - Record the voltage data of the generated electricity
        - Record data with different initial height
        - Record data with magnetic initial orientation

8. RC circuit

    - Use computerized data acquisition system
    - Learn to construct a circuit to charge a capacitor
    - Learn to construct a circuit to discharge a capacitor
    - Learn to use a voltage sensor to record the voltage on the capacitor
    - Calculate RC time constant based on resistance and capacitance
    - Introduce the transition from static circuits to oscillating circuits

9. AC circuit

    - Construct AC circuit using a circuit board
    - Measure circuit properties using computerized automated data acquisition and voltage sensor
    - Study AC circuit properties

10. Refraction and reflection

    - Use pins and plastic blocks to study light refraction
    - Laser safety
    - Use laser and plastic block to study light reflection
    - Study total internal reflection

11. Mirrors and lenses

    - Study spherical mirrors
    - Study converging and diverging lenses

12. Double slit interference

    - Learn to calculate Young's double slit interference patterns
    - Laser safety
    - Use laser to generate double slit interference

13. Diffraction Grating

- Observe how natural lights spread into assorted colors with spectrometer
- Observe fluorescent light color components
- Study diffraction using a monochromatic light source
- Introduce modern spectroscopy as a tool to study materials

14. Hydrogen spectrum & Radioactivity

- Learn to align the spectrometer, sample, and light source
- Learnt to observe first and second order spectral lines
- Learnt to identify observed spectral lines
- Radiation safety
- Learn to use Geiger counter
- Learn to measure radiation from alpha source
- Learn to measure radiation from beta source

Evaluation of student learning:

Students are expected to attend all lecture and laboratory sessions. The evaluation will be based on performance and participation. Tests and quizzes cover both lecture and laboratory materials.

Course Component	Weight	Notes
Tests	20 %	There is no makeup test. Drop one lowest score.
Final, cumulative	30 %	
Laboratory	20 %	There is no makeup lab. Drop one lowest score.
Quizzes	30 %	