# Course Outline

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY 102</td>
<td>College Physics II</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hours:</th>
<th>Pre-requisite</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture/Lab/Other 3/3/0</td>
<td>PHY 101</td>
<td>Fall 2022</td>
</tr>
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## 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:
Jing Huang  
(609) 570-3429  
huangj@mccc.edu

## 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]

MCCC Course Outline; Approved by the Curriculum Committee Fall 2021
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
- Learn to observe first and second order spectral lines
- Learn 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.

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Weight</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Tests</td>
<td>20 %</td>
<td>There is no makeup test. Drop one lowest score.</td>
</tr>
<tr>
<td>Final, cumulative</td>
<td>30 %</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>20 %</td>
<td>There is no makeup lab. Drop one lowest score.</td>
</tr>
<tr>
<td>Quizzes</td>
<td>30 %</td>
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