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  Summer 2020

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

Required texts/other materials:
College Physics, volume 2
10th edition
Serway & Vuille
Cengage

Physics 102 Laboratory
Jing Huang

Scientific Calculator

Revision date:  Course coordinator
02/24/2020  Jing Huang
                       huangj@mccc.edu
                       www.mccc.edu/~huangj

Course Competencies/Goals
Upon successfully completing the course, the student will be able to:
1. Master basic concepts and principles. (GE Goal 3, MCCC CS Goal B)
2. Develop critical thinking and problem solving skills. (GE Goals 2, 3 & 9, MCCC CS Goal B)
3. Properly use laboratory instruments and solve real world problems. (GE Goal 2, 3, 4, MCCC CS Goal B)
4. Carry out teamwork. (MCCC CS Goal F)
5. Conduct literature search, analysis, and presentation (GE Goal 1, 4, MCCC CS Goal A, D, E)
6. Understand cultural, historical, and ethical issues through solving relevant problems. (GE Goals 7, 9; MCCC CS Goals G)

Course-specific General Education Knowledge Goals and Core Skills.
General Education Knowledge Goals
Goal 1. Communication. Students will communicate effectively in both speech and writing.
Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Goal 7. History. Students will understand historical events and movements in World, Western, non-Western or American societies and assess their subsequent significance.


MCCC Core Skills

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

Goal B. Critical thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.

Goal D. 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.

Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems, and communicate with others.

Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

Goal G. Intra-Cultural and Inter-Cultural Responsibility. Students will demonstrate an awareness of the responsibilities of intelligent citizenship in a diverse and pluralistic society, and will demonstrate cultural, global, and environmental awareness.

Units of study in detail.

Unit I Electricity

Learning Objectives

The student will be able to…
- understand charges, electric field, equipotential surface, and Coulomb’s Law (CG1, CG2)
- understand current, voltage, resistance, and Ohm’s Law (CG2)
- understand DC and AC circuits. (CG1)
- understand capacitance and relation to voltage and power (CG1, CG2)
- understand electric field and the relation to charge distribution (CG1)
- improve problem solving skills by reading word problems and apply basic concepts. (CG 2)
- solve problems involving vectors. (CG2, CG4, CG5)
- solve problems in the laboratory (CG3, CG4)

Unit II Magnetism

Learning Objectives

The student will be able to…
- understand magnetic field, magnetic force, and the relation with current. (CG1, CG2, CG 6)
- understand induced voltage (CG1, CG2)
- understand energy in magnetic field (CG1)
- solve problems involving vectors. (CG2, CG4, CG5)
- solve problems in the laboratory (CG3, CG4)

Unit III Optics

Learning Objectives

The student will be able to…
- reinforce knowledge on vector reflection, refraction, and total internal refraction. (CG1)
- reinforce problem solving in mirrors and lenses. (CG2)
- understand the basic concepts involved interference, diffraction, and polarization. (CG1, CG6)
- reinforce concepts through solving problems. (CG3, CG4)
Unit IV Atomic and Nuclear Physics

Learning Objectives

The student will be able to...

• relate atomic spectrum to energy levels (CG2)
• Understand nuclear radiation types, alpha, beta, and gamma. (CG1)
• solve problem using radiation half life (CG2)
• understand environmental safety (CG6)
• understand nuclear reaction and power plants (CG5, CG6)
• measure and calculate radiation properties (CG3, CG4)

Laboratory experiments

1. Math overview & lab introduction, circuits diagram and circuit construction
   • Go over arithmetic and algebra required by solving problems (CG2)
   • Learn to graph using Excel (CG2, CG5)
   • Establish laboratory safety rules. (CG3)
   • Learn about lab report rules (CG5)

2. The electric field and equipotential surface
   • Learn to draw electric field diagram of isolated charge, parallel plates, and pair of point charges (CG1)
   • Learn to construct a circuit for measuring electric potential of a grid (CG3)
   • Learn to measure and record electric potential of a grid using a voltmeter (CG3)

3. Circuits & Capacitance
   • Learn to identify basic circuit elements in circuit diagram (CG3)
   • Learn to construct simple circuits with lab equipment (CG3)
   • Always use a circuit breaker for safety and conservation of energy (CG60)
   • Use capacitor meter to measure isolated capacitance (CG3)
   • Use capacitor meter to measure capacitors connected in series or parallel (CG3)
   • Use capacitor meter to study the relationship between capacitance and the plate separation (CG3)
   • Use Excel to graph the capacitance and plate separation relationship (CG5)
   • Use Excel to analyze the relationship between capacitance and plate separation (CG2)

4. GLX & Ohm’s law
   • Introduce computerized data acquisition using GLX (CG2)
   • Introduce Data Studio software (CG3)
   • Ammeter and voltmeter measurements (CG3)
   • Data acquisition and analysis (CG3)

5. Wheatstone bridge
   • Learn to read multi-loop circuit diagram (CG1)
   • Learn to construct multi-loop circuits (CG3)
   • Learn to analyze circuit (CG3)
   • Learn to use Galvanometer and move slider and find zero balance (CG4)

6. Earth’s magnetic field
   • Learn about earth’s magnetic field (CG1)
   • Research the magnitude and direction of the earth’s magnetic field at the location of the lab (CG5)
   • 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 in the horizontal surface (CG3)
   • For the center of the wire loop, calculate the magnitude of the magnetic field (CG2)

7. Induced voltage and magnetic field of a solenoid
   • Use GLX and voltage sensor (CG3)
- Measure the induced voltage (CG2)
- Drop a bar magnet and let it fall through a solenoid (CG4)
- Record the voltage data of the generated electricity (CG3)
- Record data with different initial height (CG2)
- Record data with magnetic initial orientation (CG2)

8. RC circuit
   - Use GLX (CG3)
   - Learn to construct a circuit to charge a capacitor (CG2)
   - Learn to construct a circuit to discharge a capacitor (CG3)
   - Learn to use a voltage sensor to record the voltage on the capacitor (CG3)
   - Calculate RC time constant based on resistance and capacitance (CG1)
   - Introduce the transition from static circuits to oscillating circuits (CG6)

9. AC circuit
   - Construct AC circuit using a circuit board (CG3)
   - Measure circuit properties using GLX and voltage sensor (CG3)
   - Study AC circuit properties (CG1, CG2)

10. Refraction and reflection
    - Use pins and plastic block to study light refraction (CG2)
    - Laser safety (CG3)
    - Use laser and plastic block to study light reflection (CG2)
    - Study total internal reflection (CG1, CG6)

11. Mirrors and lenses
    - Study spherical mirrors (CG3)
    - Study converging and diverging lenses (CG1, CG3)

12. Double slit interference
    - Learn to calculate the Young’s double slit interference patterns (CG1)
    - Laser safety (CG3)
    - Use laser to generate double slit interference (CG2, CG4)

13. Diffraction Grating
    - Observe how natural lights spread into different colors with spectrometer (CG2)
    - Observe fluorescent lights color components (CG2, CG1)
    - Study diffraction using a monochromatic light source (CG2, CG4)
    - Introduce modern spectroscopy as a tool to study materials (CG5, CG6)

14. Hydrogen spectrum
    - Learn to align the spectrometer, sample, and light source (CG2)
    - Learnt to observe first and second order spectral lines (CG1, CG3, CG4)
    - Learnt to identify observed spectral lines (CG1, CG5)

15. Radioactivity
    - Radiation safety (CG1, CG6)
    - Learn to use Geiger counter (CG3)
    - Learn to measure radiation from alpha source (CG2, CG4)
    - Learn to measure radiation from beta source (CG2, CG4)

**Evaluation of student learning:**
Students are expected to attend all lecture and laboratory sessions. The evaluation will be based on performance and participation. The laboratory score includes the laboratory reports and laboratory tests. The participation score is based on attendance and classroom contribution.

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Weight</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit tests</td>
<td>45%</td>
<td>There is no makeup test. Drop one lowest score.</td>
</tr>
<tr>
<td>Final, cumulative</td>
<td>15%</td>
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<tr>
<td>Laboratories</td>
<td>30%</td>
<td>There is no makeup lab. Drop one lowest score.</td>
</tr>
<tr>
<td>Lecture Participation</td>
<td>-5% - 5%</td>
<td></td>
</tr>
<tr>
<td>Laboratory Participation</td>
<td>-5% - 5%</td>
<td></td>
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</tbody>
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A student who has special needs because of a documented disability is entitled to receive accommodations (Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973). Students are to submit the accommodation form to the instructor at the start of the semester. For more information, contact Arlene Stinson, Director of the Center for Inclusion, Transition and Accessibility, LB 217, 570-3525, stinsona@mccc.edu

**Academic Integrity Statement:**

Mercer County Community College is committed to academic integrity – the honest, fair and continuing pursuit of knowledge, free from fraud or deception.

- Students should never:
  - Knowingly represent the work of others as their own
  - Knowingly represent previously completed academic work as current
  - Fabricate data to support academic work
  - Use or obtain unauthorized assistance in the execution of any academic work
  - Give fraudulent assistance to other students
  - Unethically use technological means to gain academic advantages

Violators of the above actions will be penalized. For a single violation the faculty member will determine the course of action. This may include, assigning a lower grade on the assignment, lowering the course grade, failing the student, or another penalty that is appropriate to the violation. The student will be reported to the Academic Integrity Committee, who may impose other penalties for a second (or later) violation. The student has right to a hearing and also to appeal any decisions. These rights are outlined in the student handbook.