



COURSE OUTLINE

Course Number

PHY 215

Course Title

University Physics II

Credits

4

Hours:

**lecture/Lab/Other
3/3/0**

Co- or Pre-requisite

**Prerequisites:
PHY 115 with grade C or better &
MAT 151 with grade C or better**

Implementation

**sem/year
Spring 2019**

Catalog description:

The second course in a calculus-based physics sequence intended for students majoring in physics, engineering science, computer science, mathematics, and other technical areas. Topics include electricity, magnetism, circuits, electromagnetic fields, as well as electromagnetic waves. The laws of physics are investigated and applied to problem solving. *3 lecture/3 laboratory hours*

Required texts/other materials:

Fundamentals of Physics, volume 2
Halliday & Resnick
John Wiley & Sons
10th Edition

Physics 215 Laboratory
MCCC

Scientific Calculator

Revision date:

02/13/2019

Course coordinator: (Name, telephone number, email address)

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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. Apply calculus in solving problems. (MCCC CS Goal B, GE Goal 2)
6. conduct literature search, analysis, and presentation (GE Goal 1, 4 , MCCC CS Goal A, D, E)
7. 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.

Goal 9. Ethical Reasoning and Action. Students will understand ethical issues and situations.

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.

General Learning Objective

The student will be able to...

- understand basic physics concepts (CG1)
- master the laws in physics (CG1, CG2)
- develop problem-solving skills (CG2)
- develop critical-thinking skills (CG2)

Unit I Electricity

Learning Objectives

The student will be able to...

- Understand electrical charges, capacitor, electrical fields, and electrical potential (CG1)
- solve problems using Gauss' Law (CG2, CG3, CG4, CG5)
- apply physics knowledge in preserving natural resources (CG6, CG 7)

Unit II Magnetism

Learning Objectives

The student will be able to...

- Understand magnetic field, induction, and inductance (CG1)

- solve problems related to electricity generation (CG2, CG3, CG4, CG5)
- apply physics knowledge in preserving natural resources (CG7)

Unit III **Circuits**

Learning Objectives

The student will be able to...

- Understand the circuit elements, resistors, capacitors, inductors, as well as power source and switches. (CG1)
- generate and interpret circuit diagrams. (CG1, CG3, CG4)
- solve problems applying Ohm's Law (CG2, CG5)

Unit IV **Electromagnetic Field**

Learning Objectives

The student will be able to...

- Understand how electromagnetic field is generated (CG1, CG6)
 - Measure the strength of electromagnetic field (CG1, CG3, CG4)
 - Understand the various electromagnetic fields in the environment (CG3)

Unit V **Electromagnetic Waves**

Learning Objectives

The student will be able to...

- Understand the different forms of electromagnetic waves (CG1, CG6)
- Solve problems applying the wave properties (CG2, CG3, CG4, CG5)
- Understand the environmental elements related to the electromagnetic waves. (CG7)

Laboratory experiments:

1. Math Overview
 - Go over algebra and calculus required by solving problems (CG2)
 - Learn to record data and graph using Excel (CG2, CG5)
 - Establish laboratory safety rules. (CG3)
 - Learn about lab report rules (CG5)
2. Electric Field
 - 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)
 - Apply calculus in deriving electric field from electric potential. (CG5)
 - Apply calculus in understanding that the electric field lines are perpendicular to the electric equipotential lines. (CG5)
3. Equipotential Surface
 - 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)
 - Use Excel to analyze equipotential data and generate three-dimensional contour plots.
4. Circuit Diagram & Construction
 - 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 (CG6)
5. Capacitors
 - 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)
6. Ohm's law
- Ammeter and voltmeter measurements (CG3)
 - Data acquisition and analysis (CG3)
 - Use Excel to process graphing and linear regression (CG2, CG3)
7. 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)
8. Kirchhoff's law
- Understand multi-loop circuit
 - Calculate multi-loop circuit
9. 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)
10. e/m ratio
- Understand magnetic field generation using electric current (CG3)
 - Understand generating free electrons (CG3)
 - Understand how to accelerate free electrons (CG3)
 - Circular motion of electrons in a magnetic field (CG3)
11. 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)
12. Induced voltage
- 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)
 - Apply calculus in interpreting the change of magnetic flux and induced voltage. (CG5)
13. Current balance
- Learn high voltage safety (CG3)
 - Review and apply rotational equilibrium (CG3)
 - Practice designing experiments (CG3)

14. Magnetic Field detection

- Use GLX and magnetic field sensor (CG3)
- Apply calculus in interpreting the magnetic field (CG5)

15. 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)
- Apply calculus in interpreting the AC circuit properties (CG5)

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.

| Course Component | Weight | Notes |
|--------------------------|----------|---|
| Unit tests | 45% | There is no makeup test. Drop one lowest score. |
| Final, cumulative | 15% | |
| Laboratories | 30% | There is no makeup lab. Drop one lowest score. |
| Lecture Participation | -5% - 5% | |
| Laboratory Participation | -5% - 5% | |

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: [Include a statement affirming the college's Academic Integrity policy and any specific implications for the course. See <http://mlink.mccc.edu/omb/OMB210.pdf>]

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.