MERCER COUNTY COMMUNITY COLLEGE

COURSE OUTLINE REVISED SPRING 2008

PHY102	**College Physics II**
COURSE NUMBER	COURSE TITLE
Science & Allied Health	**15 Weeks**
DIVISION	LENGTH OF SEMESTER

4	**3**	**3**
CREDITS	CLASS HOURS	LAB HOURS

TEXT:

TITLE:	COLLEGE PHYSICS
AUTHOR:	Serway and Vuille
PUBLISHER:	Brooks-Cole Publishing Co.
EDITION:	8th Ed.
TITLE:	Experiments in College Physics
AUTHOR:	Cioffari
PUBLISHER:	D.C. Heath
EDITION:	10th

CATALOG DESCRIPTION:
The second semester of a two semester non-calculus sequence. Topics covered include electricity, magnetism, optics, atomic physics and nuclear physics.

PREREQUISITES: PHY101 and MAT115

COREQUISITES: MAT116

Dominick Misciascio
Course Coordinator

This course is to be divided into three units of five weeks each.

General Objectives:

a. The students will be taking a non-calculus physics course offered in most four-year colleges and universities for non-engineering science majors.

b. The student is expected to have previous knowledge of algebra and will learn how to use scientific instruments such as the micrometer microscope, spherical micrometer, and spectroscope.

c. The students will be able to solve physics problems by applying mathematical logic and methods to prove natural laws of physics and definitions.

d. The student will be able to realize that physics is not a course that depends on memorization; that is a course in logic, and will be expected to demonstrate this by solving physics problems using mathematical logic and methods.

Specific Objectives:

UNIT I ELECTRICITY

The student will be able to:

I. Electric Charge and Field

a. State the function of an electroscope.
b. Recognize the conducting qualities of different substances.
c. Define Coulomb's Law and apply it to charged spheres.
d. Distinguish between a conductor and an insulator.
e. Translate Coulomb's Law into equation form and handle basic problems determining force.

II. Electrical Energy

a. Understand the basic functions of a battery.
b. Summarize Ohm's Law
c. Apply the principle of electrical resistance to a conductor.
d. State and understand the law of series resistance.
e. Apply Kirchhoff's First and Second Laws to electrical circuits.
f. Solve problems dealing with resistors in series and those in parallel.

III. Electrical Circuits

a. Summarize what is meant by an electric field and electric field intensity.
b. Define the electric potential of a charged body and describe the meaning of an electrical potential of a point in space.
c. Discuss the significance of the volt.
d. List the essential elements of a capacitor.
e. Define the terms farad and microfarad.
f. Discuss the laws of parallel capacitors and series capacitors.
g. Solve problems dealing with electrical potential and electric field intensity.

UNIT ONE TEST SHOULD BE GIVEN AT THIS POINT. (Chapters 15 -18)

UNIT II. MAGNETISM

The student will be able to:

I. Electromagnetism

a. State Coulomb's Law regarding magnetic poles.
b. Solve problems applying Coulomb's Law to magnetic poles and determine magnetic field strength.
c. Describe and evaluate the basic effects produced by electric currents.
d. Describe the importance of the left-hand rule in electromagnetism.
e. Discuss the induced electromotive force and relate it to Faraday's Law.
f. Recognize the basic principles of an electric motor.

II. Applied Electricity

a. Cite the differences between a direct and an alternating current.
b. Explain the purpose of a transformer and know basically how it is constructed.
c. Define inductance and describe the factors involving the inductance of a coil.
d. Explain the difference between inductive and capacitive reactance.
e. Define impedance and relate it to the term "power factor".

UNIT TWO TEST SHOULD BE GIVEN AT THIS POINT. (Chapters 19 – 21)

UNIT III OPTICS

The student will be able to:

I. Geometrical Optics

a. Cite the differences among geometrical, physical and quantum optics.
b. Explain Fizeau's method for determining the speed of light.
c. Express the index of refraction as a fraction.
d. Illustrate lateral displacement of light through a parallel plate of glass.
e. Identify a critical angle and recognize the conditions under which it forms.

II. Lenses and Mirrors

a. Distinguish between focal length and focal plane.
b. Distinguish between a real and a critical image.
c. Give a quantitative relation for calculating image magnification.
d. Determine graphically and by calculating problems dealing with image distances, image size, and magnification.

III. Wave Optics

a. Define diffraction and differentiate it from refraction.
b. Describe observations from Young's double split experiment.
c. Define the angstrom as a unit of length.
d. Describe the uses of a diffraction grating.
e. Identify the basic purpose of a spectrograph and discuss the various types used currently.

IV. Interferometry

a. Explain Huygen's principle.
b. Explain and demonstrate the formation of Newton's rings in the laboratory.
c. State the practical significance of an Airy disk.
d. Explain the difference between the diffraction pattern of a circular aperture and that from a single slit.
e. Analyze the production of coherent sources of light.

V. Applied Optics

a. Define plane polarized light.
b. Identify Brewster's angle and describe how it is determined.
c. State the difference between a reflecting and refracting telescope.
d. Describe the helium-neon gas laser and explain how it operates.
e. Define the process of optical pumping and identify briefly metastable and semi-metastable states.

UNIT THREE TEST SHOULD BE GIVEN AT THIS POINT. (Chapters 22 – 25)

UNIT IV. MODERN PHYSICS

The student will be able to:

I. Relativity
a. Describe a Galilean-Newton transformation.
b. Give the results of a Gadeken experiment.
c. Give a diagrammatic explanation of a Lorentz-Fitzgerald contraction.
d. Recognize the relative velocity equation for moving frames of reference, the equation for velocity of a moving mass, and Einstein's mass-energy equation.
e. Explain fully Einstein's special theory of relativity.

II. Electrons and Photons
a. Differentiate between photoelectrons and cathode rays.
b. Discuss the significance of Einstein's photoelectric equation.
c. State the significance of Millikan's experimental determination of the value of "h".
d. Write the photoelectric equation and explain each term.
e. Define secondary electrons and explain how they differ from primary electrons.
f. Understand the principles of six stage photomultiplier tube.

III. The Outer Atom

a. Describe the configuration of the Thompson atom.
b. Explain the mathematical relationship proposed by Bohr in his three theories about the hydrogen atom.
c. Draw the first four Bohr circular orbits of hydrogen and show the transitions giving rise to the first line of the Lyman series, the Balmer series, and the Paschen series.
d. Diagram a potassium atom and show the correct number of electrons found in each orbit.
e. Understand the basic rules of filling subshells.

IV. The Nucleus

a. Describe briefly the historical experiment used for determining the nature of alpha particles.
b. Describe the relative penetrating and ionizing powers of alpha, beta, and gamma rays.
c. Distinguish between half life and mean life of a radioactive element.
d. Explain the significance of a radioactive series.
e. Summarize Chadwick's discovery of the neutron.
f. Describe the Rutherford scattering experiments.

V. Applied Nuclear Physics

a. Analyze the Cockcroft-Walton experiment.
b. Understand the basic principles and describe the functions of a cyclotron.
c. Summarize the Mossbauer effect.
d. Differentiate between the processes of fission and fusion.
e. Classify the elementary particles as leptons, mesons, and baryons.

UNIT FOUR <u>TEST</u> SHOULD BE GIVEN AT THIS TIME. (Chapters 26 – 30)

EXPERIMENTS

GENERAL OBJECTIVES

I. The student will be able to learn to write a lab report and will be able to collect data in the proper manner.
II. The student will learn to draw graphs and be able to use slope-intercept method to analyze data.
III. The student will be able to learn the use of the Wang calculator in doing arithmetic computations and use its card programmer to analyze data.
IV. The student will learn to write conclusions and make error analysis of his/her experimental results.

SPECIFIC OBJECTIVES

I. Equipotential Lines
   A. The student will learn the use of the vacuum-tube voltmeter.
   B. The student will study the electric field lines around various geometries.
II. Ohm's Law
   A. The student will learn the use of an ammeter and voltmeter, write a lab report and analyze data.
   B. The student will find resistance from a graph of current versus voltage.

III. Wheatstone Bridge
   A. The student will measure resistance using Kirchhogg's Laws.
   B. The resistivity of a sample of wire will be determined.

IV. Potentiometer
   A. The student will measure the output voltage and internal resistance of a dry cell.
   B. The student will measure and calculate the effective potential difference of two dry cells in a parallel and in series.

V. Tangent Galvanometer
   A. The student will measure the earth's magnetic field.

VI. AC Circuits
   A. The student will calculate the impedance of an RLC circuit.
   B. The student will determine the conditions for current resonance.

VII. Index of Refraction
   A. Using Snell's Law, the student will determine the index of refraction using flass, plastic, plastic, water and alcohol.

VIII. Lenses
   A. The student will measure the focal length of a converging lens.
   B. The student will construct a reflecting telescope.

IX. Mirrors

A. The student will measure the focal length of a concave mirror.
B. The student will construct a reflecting telescope.

X. Diffraction Grating
A. The student will test the Brag Diffraction equation.
B. The student will calculate the wavelengths of the mercury spectra.

XI. Spectroscope
A. The student will measure the wavelengths of the spectral lines of helium.
B. The student will plot a calibration curve.

XII. Geiger Counter
A. The student will learn the use of the Geiger counter.
B. The student will find a relationship between distance and intensity of a radioactive source.

XIII. Nuclear Absorption
A. The student will be able to identify alpha, beta, and gamma radiation.
B. The student will calculate various absorption coefficients.

XIV. Statistics of Nuclear Counting
A. The student will plot a Gaussian curve and measure various properties such as standard deviation and variance.

UNIT ONE AND TWO EXPERIMENTS ARE I THROUGH IV.
UNIT THREE EXPERIMENTS ARE VII THROUGH X.
UNIT FOUR EXPERIMENTS ARE XI THROUGH XIV.

Revised May 2008

Dominick Misciascio
Course Coordinator