PHY 252
GENERAL PHYSICS II

COURSE DESCRIPTION:

Prerequisites: MAT 272 and PHY 251
Corequisites: None

This course uses calculus-based mathematical models to introduce the fundamental concepts that describe the physical world. Topics include electrostatic forces, electric fields, electric potentials, direct-current circuits, magnetostatic forces, magnetic fields, electromagnetic induction, alternating-current circuits, and light. Upon completion, students should be able to demonstrate an understanding of the principles involved and display analytical problem-solving ability for the topics covered. Laboratory experiments, some of which are computer-based, and computer-based tutorials enhance and consolidate the basic principles discussed in the theoretical section of the course. *This course has been approved to satisfy the Comprehensive Articulation Agreement for the general education core requirement in natural sciences-mathematics.* Course Hours Per Week: Class, 3. Lab, 3. Semester Hours Credit, 4.

LEARNING OUTCOMES:

Upon completion of this course, the student will demonstrate basic knowledge in the following:

a. Electric fields.
b. Gauss' law.
c. Electric potential.
d. Capacitance and dielectrics.
e. Current and resistance.
f. Direct current circuits.
g. Magnetic fields.
h. Magnetic field sources.
i. Faraday's law.
j. Inductance.
k. Alternating current circuits.
l. Electromagnetic waves.
m. The nature of light and geometric optics.
n. Interference of light waves.
o. Diffraction and polarization.

OUTLINE OF INSTRUCTION:

I. Electric fields
   A. Properties of electric charges
   B. Insulators and conductors
   C. Coulomb's law
   D. The electric field
   E. Motion or charged particles in a uniform electric field

II. Gauss' law
   A. Electric flux
   B. Gauss' law
   C. Application of Gauss' law to charged insulators
   D. Conductors in electrostatic equilibruim

III. Electric potential
   A. Potential difference and electric potential
   B. Potential differences in a uniform electric field
   C. Electric potential and potential energy due to point charges
   D. Electric potential due to continuous charge distributions
   E. Potential of a charged conductor

IV. Capacitance and dielectrics
   A. Definition of capacitance
   B. Calculation of capacitance
   C. Combinations of capacitors
   D. Energy stored in a charged capacitor
   E. Capacitors with dielectrics

V. Current and resistance
   A. Batteries
   B. Electric current
   C. Resistance and Ohm's law
   D. Resistivity
   E. Electrical energy and power

VI. Direct current circuits
   A. Electromotive force
   B. Series and parallel resistors
   C. Kirchhoff's rules
   D. RC circuits

VII. Magnetic Fields
   A. Properties of the magnetic field
   B. Magnetic force on a current carrying conductor
   C. The galvanometer
   D. Motion of a charged particle in a magnetic field

VIII. Magnetic field sources
   A. The Biot-Savart law
   B. The magnetic force between two parallel conductors
   C. Ampere's law
   D. The magnetic field of a solenoid
   E. Magnetic flux
   F. Gauss' law of magnetism
   G. Magnetism in matter

IX. Faraday's law
- A. Faraday's law of induction
- B. Motional EMF
- C. Lenz' law
- D. Induced EMF's

X. Inductance
- A. Self-inductance
- B. RL circuits
- C. Energy in a magnetic field
- D. Oscillations on an LC circuit

XI. Alternating-Current circuits
- A. Resistors, inductors and capacitors in an AC circuit
- B. The RLC series circuit
- C. Power in an AC circuit
- D. Resonance in a series RLC circuit

XII. Electromagnetic waves
- A. Maxwell's equations and Hertz's laws
- B. Plane electromagnetic waves
- C. Energy and momentum of electromagnetic waves
- D. The electromagnetic spectrum

XIII. Light and Geometric Optics
- A. The nature of light
- B. Measurements of the speed of light
- C. Huygens's principle
- D. Ray approximations
- E. Reflections and refraction
- F. Images formed by mirrors and refraction
- G. Thin lenses
- H. Optical devices

XIV. Interference of light waves
- A. Conditions for interference
- B. Young's double-slit experiment
- C. Phasor addition of waves
- D. Phase change due to reflection
- E. Interference in thin films

XV. Diffraction and polarization
- A. Introduction to diffraction
- B. Single-slit diffraction
- C. Resolution
- D. The diffraction grating
- E. Polarization

REQUIRED TEXTBOOK AND MATERIALS:

Knight, R. D. Physics for Scientists and Engineers, with Modern Physics. 2nd ed. San Francisco, Addison Wesley, 2004.

Knight, R. D., Student Workbook with Modern Physics. .2nd ed. San Francisco, Addison Wesley, 2004.

Programmable scientific calculator.

SUGGESTED REFERENCES, PERIODICALS, AND VISUAL AIDS:

Numerous supplementary texts, programmed materials, and audiovisual packages are available in the Educational Resources Center. These materials may be utilized to reinforce the lecture and lab material or to provide material for independent study by the student.

STATEMENT OF STUDENTS WITH DISABILITIES:

Students who require academic accommodations due to any physical, psychological, or learning disability are encouraged to request assistance from a disability services counselor within the first two weeks of class. Likewise, students who potentially require emergency medical attention due to any chronic health condition are encouraged to disclose this information to a disability services counselor within the first two weeks of class. Counselors can be contacted by calling 919-536-7207, ext. 1413 or by visiting the Student Development Office in the Phail Wynn Jr. Student Services Center, room 1209.