VIRGINIA STATE UNIVERSITY
School of Engineering, Science and Technology
Department of Physics
COURSE SYLLABUS: SPRING SEMESTER, 2004
PHYSICS 117 General College Physics II (Lecture) 3 hrs credit

INSTRUCTOR: Carey E. Stronach, Ph.D., Professor of Physics

OFFICE: 104S Hunter-McDaniel Building

OFFICE HOURS: Monday: 11:00 am - 12:00 n & 3:30 - 5:00 pm;
Tuesday: 10:00 - 11:00 am; Wednesday: 10:00 - 11:00 am;
Thursday: 11:00 am - 12:00 n and 3:00 - 4:00pm;
Friday: 10:00 - 11:00 am & 3:00 - 4:00 pm.

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COURSE DESCRIPTION: PHYS 117, General College Physics II, is a continuation of the study of the basic concepts of physics including heat and thermodynamics, wave motion, sound, electric charges and currents, electric and magnetic fields, electromagnetic waves including light, relativity, quantum physics, atomic and molecular structure, nuclear forces, reactions and structure, and elementary particles. This course is designed for science students not majoring in physics.

PREREQUISITES: College Algebra and Trigonometry, or the equivalent, and Physics 116.

COURSE TEXTBOOK: College Physics, by Giambattista, Richardson & Richardson, 2004, McGraw-Hill, ISBN 0-07-052407-6.

CLASS MEETING PLACE AND TIMES: 156W Hunter-McDaniel Building, 9:00 - 9:50 am MWF.

NECESSARY SUPPLIES: Calculator, French curve (including straightedge and protractor) and graph paper.

LEARNING OUTCOMES, ACTIVITIES, AND EVALUATION PROCEDURES:

KNOWLEDGE

The student will:

- State the definitions of specific heat, heat of fusion, and heat of vaporization
  Evaluation strategies: Quizzes, homework, final examination

- State the first and second laws of thermodynamics and the definition of entropy
  Evaluation strategies: Quizzes, homework, final examination

- State Hooke's Law
  Evaluation strategies: Quizzes, homework, final examination

- Describe simple harmonic motion.
  Evaluation strategies: Quizzes, homework, final examination

- State the definitions of amplitude, frequency and wavelength.
  Evaluation strategies: Quizzes, homework, final examination

- Describe superposition and interference of waves.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the characteristics of sound waves.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the distinction between longitudinal and transverse waves.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the properties of standing waves.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the Doppler effect.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the relation between quality of sound and characteristics of musical instruments.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the structure of the human ear.
  Evaluation strategies: Quizzes, homework, final examination

- Describe electric charges and their roles in the structure of matter**.**
  Evaluation strategies: Quizzes, homework, final examination

- State Coulomb's law.
  Evaluation strategies: Quizzes, final examination

- Define the concept of electric field.
  Evaluation strategies: Quizzes, homework, final examination

- State the law of conservation of electric charge.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the quantization of electric charge.
  Evaluation strategies: Quizzes, final examination

- Define electrostatic potential, equipotential surfaces, and potential energy due to point charges.
  Evaluation strategies: Quizzes, homework, final examination

- Define capacitance and energy storage in capacitors.
  Evaluation strategies: Quizzes, homework, final examination

- Define electric current.
  Evaluation strategies: Quizzes, homework, final examination

- Make the distinction between superconductors, conductors, semiconductors, and insulators.
  Evaluation strategies: Quizzes, homework, final examination

- Define conductivity and resistivity.
  Evaluation strategies: Quizzes, homework, final examination

- State Ohm's law.
  Evaluation strategies: Quizzes, homework, final examination

- Define conductance and resistance.
  Evaluation strategies: Quizzes. homework, final examination

- Define and describe electric power and electric energy.
  Evaluation strategies: Quizzes. homework, final examination

- State Kirchhoff's rules.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the properties of magnets and the properties of the Earth's magnetic field.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the production of magnetic fields by moving electric charges and the exertion of magnetic forces on moving electric charges.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the properties of diamagnetic, paramagnetic, spin glass, ferromagnetic, and antiferromagnetic materials.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the atomic and domain structure of magnetically ordered materials.
  Evaluation strategies: Quizzes. homework, final examination

- State Faraday's law of induction and Lenz's law.
  Evaluation strategies: Quizzes. homework, final examination

- Describe how motors, generators, and transformers are constructed.
  Evaluation strategies: Quizzes. homework, final examination

- Define resistance, reactance, and impedance for AC circuits.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the transmission of electric power in AC circuits.
  Evaluation strategies: Quizzes. homework, final examination

- Describe how the laws of electromagnetism are summarized in Maxwell's equations.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the properties of electromagnetic waves.
  Evaluation strategies: Quizzes. homework, final examination

- Describe how the speed of light is measured.
  Evaluation strategies: Quizzes. homework, final examination

- State the laws of reflection and refraction and describe how images are formed by reflection and refraction.
  Evaluation strategies: Quizzes. homework, final examination

- Describe how interference and diffraction occur.
  Evaluation strategies: Quizzes. homework, final examination

- State the Rayleigh criterion.
  Evaluation strategies: Quizzes. homework, final examination

- Describe how eyes, cameras, microscopes and telescopes work.
  Evaluation strategies: Quizzes. homework, final examination

- State the principles of relativity and the fact that the speed of light in vacuum is the ultimate speed.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the fundamental identity of mass and energy.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the relativistic connection between electric and magnetic fields.
  Evaluation strategies: Quizzes. homework, final examination

- Describe Planck' s explanation of the quantized nature of the emission of radiation.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the photoelectric effect and the Compton effect.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the wave-particle duality of nature.
  Evaluation strategies: Quizzes. homework, final examination

- State the uncertainty principle.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the quantum explanation of atomic structure and spectra.
  Evaluation strategies: Quizzes. homework, final examination

- Describe electron spin and state the Pauli exclusion principle.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the basic properties of atomic nuclei.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the common types of radioactivity (α, β, γ).
  Evaluation strategies: Quizzes. homework, final examination

- State the rules of nuclear reactions.
  Evaluation strategies: Quizzes. homework, final examination

- Describe nuclear fission and fusion processes, and how nuclear reactors work.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the classification rules for elementary particles.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the distinction between bosons and fermions, and the distinction between leptons and quarks.
  Evaluation strategies: Quizzes. homework, final examination

- List and describe the basic interactions in nature.
  Evaluation strategies: Quizzes. homework, final examination

- State the conservation laws for baryon number and the three lepton numbers.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the distinction between particles and antiparticles.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the roles of quarks, gluons, neutrinos, weak bosons, and mesons.
  Evaluation strategies: Quizzes. homework, final examination

- List and describe the partially-conserved quantities.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the role of the Higgs particle.
  Evaluation strategies: Quizzes. homework, final examination

- Describe the "big bang".
  Evaluation strategies: Quizzes. homework, final examination

SKILLS

The student will:

- Solve basic problems on simple harmonic motion, wave motion and sound.
  Evaluation strategies: Quizzes, homework, final examination

- Calculate the electric fields and electrostatic potentials for simple charge distributions.
  Evaluation strategies: Quizzes, homework, final examination

- Calculate the capacitance of series and parallel arrangements of capacitors.
  Evaluation strategies: Quizzes, homework, final examination

- Calculate the resistance of series and parallel arrangements of resistors.
  Evaluation strategies: Quizzes, homework, final examination

- Solve DC circuit problems using Kirchhoff' s rules.
  Evaluation strategies: Quizzes, homework, final examination

- Calculate the magnetic field due to a simple current distribution.
  Evaluation strategies: Quizzes, homework, final examination

- Solve basic problems involving electromagnetic induction.
  Evaluation strategies: Quizzes, homework, final examination

- Calculate the rms current in a series AC circuit and calculate the *rms* voltages across circuit elements.
  Evaluation strategies: Quizzes, homework, final examination

- Solve ray diagram problems for mirrors and thin lenses.
  Evaluation strategies: Quizzes, homework, final examination

- Do basic calculations in relativistic kinematics and dynamics.
  Evaluation strategies: Quizzes, homework, final examination

- Do basic calculations in quantum physics utilizing the energy/frequency relationship, the deBroglie wavelength and the uncertainty principle.
  Evaluation strategies: Quizzes, homework, final examination

- Explain atomic spectra, electron energy levels, and the periodic table using the exclusion principle.
  Evaluation strategies: Quizzes, homework, final examination

- Describe the basic facts of nuclear structure.
  Evaluation strategies: Quizzes, homework, final examination

- Explain nuclear decay processes.
  Evaluation strategies: Quizzes, homework, final examination

- Outline the classification system of elementary particles.
  Evaluation strategies: Quizzes, homework, final examination

- Use the conservation laws to determine whether or not a simple particle decay or interaction scheme is possible.
  Evaluation strategies: Quizzes, homework, final examination

ABILITIES

The student will:

- Draw diagrams necessary to solve problems.
  Evaluation strategies: Quizzes, homework, final examination

- Display data on graphs.
  Evaluation strategies: Quizzes, homework, final examination

- Set up and solve basic problems in wave motion, electromagnetism, optics, special relativity, quantum physics, atomic structure, nuclear structure and reactions, and elementary particles.
  Evaluation strategies: Quizzes, homework, final examination

- Distinguish sense from nonsense.
  Evaluation strategies: Quizzes, homework, class discussion, final examination

- Analyze situations and develop rational courses of action.
  Evaluation strategies: Quizzes, homework, class discussion, final examination

- Determine the appropriate physical laws to apply to a situation.
  Evaluation strategies: Quizzes, homework, final examination

- Develop an approach to the world around oneself based on the laws of nature and informed common sense.
  Evaluation strategies: Quizzes, homework, class discussion, final examination

- Distinguish between reality and superstition, and between science and pseudo science.
  Evaluation strategies: Quizzes, homework, class discussion, final examination

COURSE REQUIREMENTS

General academic regulations are described in the University Catalog and in the Student Handbook. Some relevant policies from the Catalog are included at the end of this syllabus.

Students to whom the *Americans with Disabilities Act* applies should consult with the instructor about special course arrangements.

Course requirements will include the following:

A. Quizzes

Five quizzes will be given during the semester. The best **three** will be counted. There will be **no make-ups for missed quizzes**. Collectively the three quizzes that are counted will constitute **100%** of the semester grade (each counted quiz constitutes 33.3%). The *tentative* quiz dates and the sections in the text to which they relate are given below:

Quiz #1: Chapters 11 - 13; January 30, 2004
Quiz #2: Chapters 14 - 17; February 13, 2004
Quiz #3: Chapters 16 - 18; March 5, 2004
Quiz #4: Chapters 19 - 22; April 9, 2004
Quiz #5: Chapters 23 - 30; April 28(?), 2004

B. Final Examination

The final examination period will be used for quiz #5, which will include review material in addition to Chapters 23 - 30.

GRADING STANDARDS

The course grade will be based on the following items, which are discussed above:

Quizzes (five, with the best three counted) ---------- 100%

The standard University grading scale will be employed:

A: 90 - 100
B: 80 - 89
C: 70 - 79
D: 60 - 69
F: 0 - 59

REFERENCE BOOKS:

The following texts may be useful:

Physics, by D.C. Giancoli, Prentice-Hall Publishing Co.

Contemporary College Physics, by Jones & Childers, McGraw-Hill.

College Physics, Sixth Edition, by Serway & Faughn, Brooks-Cole.

College Physics, Second Edition, by Urone, Brooks-Cole.

The instructor recommends the following study guides:

Schaum' s Outline Series, volume on College Physics.

The Physics Toolbox, by Hubbard & Katz, Brooks-Cole.

COURSE OUTLINE - PHYSICS 117

I. **Vibrations and Wave Motion**
   a. Hooke's law
   b. Oscillatory motion
   c. Springs and pendula
   d. Wave motion
   e. Sound waves
   f. Doppler effect

II. **Heat and Thermodynamics**
   a. Kinetic theory of gases
   b. Specific heat, heat of fusion, & heat of vaporization
   c. Heat transfer
   d. First law of thermodynamics
   e. Second law of thermodynamics
   f. Entropy, probability, disorder, and time's arrow

III. **Electromagnetism**
   a. Electric forces & fields
   b. Electric energy, potential & capacitance
   c. Current, resistance & DC circuits
   d. Magnetism
   e. The relation between electricity and magnetism
   f. AC circuits
   g. Electromagnetic waves

IV. **Light and Optics**
   a. Reflection & refraction
   b. Mirrors & lenses
   c. Wave optics
   d. Optical instruments

V. **Relativity**
   a. The principles of relativity
   b. Relativistic kinematics
   c. Relativistic dynamics
   d. General relativity/gravitation

VI. **Quantum Physics**

a. The old quantum theory
b. Principles of quantum mechanics
c. Atomic structure
d. Molecules & solids
e. Nuclear physics
f. Elementary particles

The purposes of this course are (1) to provide the student with a basic knowledge of wave motion, heat and thermodynamics, electromagnetism, light & optics, relativity, and quantum mechanics, (2) to provide the student with a sufficient background in these areas so that the student will then be ready to take advanced courses in these areas, (3) to provide the student with the knowledge of these areas necessary to the pursuit of his/her major course of study in science or engineering, (4) to develop in the student an analytic approach to problem solving, both in science and "everyday life", and (5) to develop in the student an appreciation of the role of science in our current society, and in the past, and what it is likely to be in the future.