Butler Community College
Behavior Science, Math, Science, and
Physical Education Division

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Revised Fall 2008
Implemented Spring 2009

COURSE OUTLINE
General Physics I

Course Description
PH 143. General Physics I. 5 hours credit. Prerequisite: MA 131 or MA 135 with a C or better. MA 140 with a C or better is recommended. This course will enable the student to understand the principles of mechanics, heat, and thermodynamics, and wave motion and sound. The student will perform laboratory experiments enhance the concepts listed above as well as introduction to the principles and techniques of scientific investigation and data handling. This course is intended for students in life science, pre-med, pre-dental, pre-vet, the general liberal arts, business and pre-teaching.

Course Relevance
The impact of physics in everyday life is phenomenal. The ability to see physics in action is necessary to develop a fuller knowledge and understanding of the world around us. Physics will enrich the student's appreciation of the world and help him/her better understand the studies of science and the scientific methods.

Required Materials
Cutnell, J. (2006). *Physics: Vol 1*. (7th ed.). Hoboken, NJ: Wiley.

Learning Outcomes
The intention is for the student to be able to:
1. Understand of the scientific method.
2. Read, discuss, and understand scientific materials.
3. Demonstrate knowledge of basic physics and math skills.
4. Apply scientific reasoning to real world problems.

Learning PACT Skills that will be DEVELOPED and/or documented in this course
Through involvement in this course, the student will develop ability in the following PACT skill area(s):

Personal Development Skills
1. Personal management
   - Through the production of either an essay or questionnaire the student will reflect on his/her personal management skills.

Analytical Thinking Skills
1. Critical thinking
   - Through the production of various mathematical, graphical, experimental and written assignments, the student will demonstrate scientific reasoning.

Communication Skills
1. Creation and delivery of messages
   - Through a variety of methods using either the internet and/or computer the student will produce a lab report to express his/her findings.

Technology Skills

1. General computer use
    - Through the production of electronic-facilitated research, preparing the graphs, and manipulation of data, the student develops basic computer skills

Major Summative Assessment Task(s)

These learning outcome(s) and the Learning PACT skill(s) will be demonstrated by

1. Completing the departmental comprehensive final.
2. Writing a research paper or project.
3. Completing a student self-assessment.

Course Content

I. Skills/Competencies – Actions that are essential to achieve the course outcomes:
    A. Apply basic mathematical concepts
    B. Write a research paper
    C. Prepare lab reports
II. Themes – Key recurring concepts that run throughout this course:
    A. Scientific method
    B. Scientific reasoning
III. Issues – Key areas of conflict that must be understood in order to achieve the intended outcome:
    A. The balance between the conceptual and mathematical models.
    B. The cumulative nature of science and the world.
    C. The cumulative influence of scientific discoveries and the subsequent application of the discoveries.
    D. The balance between lab science and computer interfacing, collection, and analysis of data.
IV. Concepts – Key concepts that must be understood to address the issues:
    A. Mathematics
    B. Scientific method
    C. Scientific reasoning
    D. Scientific writing
    E. Scientific principles
    F. MLA writing format
    G. Word processing
    H. Excel spreadsheet
    I. Graphing

Learning Units

I. Units and problem solving
    A. Define general concepts of physics
    B. Describe the system of units and explain its advantages
    C. Check for correctness of an equation using dimensional analysis
    D. Explain the reason for using significant digits, state the correct significant digits in a number, and write numbers in scientific (power of 10) notation
    E. Work problems using unit conversions

F. Apply the process for problem solving to the solution of exercises

II. Kinematics
   A. Define position, distance, and displacement
   B. Define speed and velocity
   C. Define acceleration
   D. Construct graphs of position versus time, velocity versus time and acceleration versus time
   E. Solve problems using the equations of motion
   F. Solve free fall problems

III. Vectors
   A. Define scalar quantities
   B. Define vector quantities
   C. Define and break down vector units
   D. Describe vector position, displacement, velocity, and acceleration
   E. Describe and give examples of relative motion

IV. Two dimensional kinetics
   A. Solve two dimensional motion problems
   B. Describe the characteristics of projectile motion

V. Newton's Law of Motion
   A. Define and work force problems
   B. Define mass
   C. Define and work problems using the three Newton's laws

VI. Application of Newton's Laws
   A. Define and work problems using friction
   B. Construct free body diagrams for various string problems
   C. Construct free body diagrams for various spring problems
   D. Define translational equilibrium
   E. Define and work problems using centripetal force

VII. Work and kinetic energy
   A. Define and solve work problems
   B. Define and solve problems using kinetic energy
   C. Manipulate the Work-Energy theorem
   D. Define and work power problems

VIII. Linear momentum and collisions
   A. Define and work problems using linear momentum and impulse
   B. Describe the conservation of momentum
   C. Examine collisions
   D. Explore the center of mass

IX. Rotational kinetics and energy
   A. Explore angular variables
   B. Manipulate equations for rotational kinematics
   C. Draw connections with linear variables
   D. Describe rolling
   E. Explore rotational kinetic energy

X. Rotational dynamics and static equilibrium
   A. Define and solve torque problems
   B. Apply angular momentum
   C. Discuss rotational work
   D. Apply vectors in rotational motion

XI. Gravity
   A. Explore Newton's law of universal gravitation
   B. Discuss Kepler's laws of motion
   C. Examine gravitational potential energy

XII. Oscillations about equilibrium
   A. Discuss periodic motion
   B. Describe simple harmonic motion
   C. Solve problems with a mass on a spring
   D. Solve problems with a pendulum
   E. Apply the conservation of energy
   F. Discuss damped and driven oscillations and resonance

XIII. Wave and sound
   A. Discuss the types of waves
   B. Discuss the various aspects of sound waves
   C. Describe superposition and interference in waves

XIV. Fluids
   A. Describe and work problems in density
   B. Describe and work problems with pressure
   C. Examine fluid statics
   D. Examine fluid dynamics

XV. Temperature and heat
   A. Define temperature and heat
   B. Examine thermal expansion
   C. Work energy transfer problems
   D. Discuss mechanisms of heat exchange

XVI. Phases and phase changes
   A. Define and solve problems using the ideal gas equation
   B. Discuss the mole

C. Explore the kinetic theory of gases
D. Discuss the mechanical properties of solids
E. Explore phase equilibrium
F. Define latent heat
G. Construct phase diagrams and the relationship of energy conservation

XVII. The Laws of Thermodynamics
A. Define and apply the zeroth law of thermodynamics
B. Define and apply the first law of thermodynamics
C. Define and apply the second law of thermodynamics
D. Define and apply the third law of thermodynamics

Learning Activities
Independent and collaborative learning activities will be assigned within and outside the classroom and laboratory to achieve the intended course outcomes. Classroom discussion, lecture, and textbook reading assignments will also contribute to the learning process.

Grade Determination
Grade determination will be based on the research paper, tests, lab reports, and comprehensive final exam. Other methods such as quizzes, homework may be used at the discretion of the instructor. The departmental final and student self evaluations are department requirements.