COURSE OUTLINE
General Physics 1

Course Description
PH 143. General Physics 1. 5 hours credit. Prerequisite: MA 135 (or MA132, MA133 and MA134) 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, thermodynamics, wave motion, and sound. The student will perform laboratory experiments that will demonstrate the concepts listed above as well as introduce/reinforce 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. The student will participate in 3 hours of lecture/discussion and 4 hours of laboratory time per week. The learning outcomes and competencies detailed in this outline meet, or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Project for this course, as approved by the Kansas Board of Regents (Transfers as PHY1010).

Required Materials
For complete material(s) information, refer to https://bookstore.butlercc.edu

Butler-Assessed Outcomes
The intention is for the student to be able to
1. Demonstrate scientific methods.
2. Demonstrate knowledge of basic math skills as they relate to physics.
3. Apply scientific reasoning to real world problems in physics.

Learning PACT Skills that will be developed and documented in this course
Through involvement in this course, the student will develop ability in the following PACT skill area(s):
Communication Skills
• Creation and delivery of messages - Through a variety of methods using the internet and/or computer, the student will produce a product to express findings for laboratory reports.

Technology Skills
• General computer use - Through electronic-facilitated research and manipulation of data, the student will develop basic computer skills.

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

Major Summative Assessment Task(s)
These Butler-assessed Outcome(s) and Learning PACT skill(s) will be demonstrated by
1. Completing a portfolio of laboratory reports including purpose, procedures, observations, and analysis of the experiment using scientific reasoning (A-skill and T-skill).
2. Writing a research paper or preparing a project on a topic of physics (C-skill).

Skills or Competencies
These actions are essential to achieve the course outcomes:
1. Use basic computer skills.
2. Solve basic mathematical problems related to the sciences.

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 Newton’s Laws of Motion
VI. Application of Newton’s Laws
A. Define friction and apply concept to problems
B. Construct free body diagrams for various string problems
C. Construct free body diagrams for various spring problems
D. Define translational equilibrium
E. Define centripetal force and apply concept to problems

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

VIII. Linear momentum and collisions
A. Define linear momentum and impulse and apply concept to problems
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 torque and apply concept to problems
B. Apply angular momentum
C. Discuss rotational work
D. Apply vectors to 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 involving a mass on a spring
D. Solve problems using a pendulum
E. Use 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 density in fluids and apply concept to problems
   B. Describe pressure in fluids and apply concept to problems
   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 to illustrate 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
Learning activities will be assigned to assist the student to achieve the intended learning outcome(s) through lecture, instructor-led class discussion, guest speakers, group activities, drills/skill practice, labs, and other activities at the discretion of the instructor. These activities may be either face-to-face or online.

Grade Determination
The student will be graded on learning activities and assessment tasks. Grade determinants may include the following: daily work, lab reports, research papers, quizzes, chapter or unit tests, comprehensive examinations, projects, presentations, class participation, and other methods of evaluation at the discretion of the instructor.