-Class Hours: 3.0 Credit Hours: 4.0
Laboratory Hours: 3.0 Revised: Spring 2011

Catalog Course Description:

A calculus-based introduction to mechanics and heat. This course covers vectors, Newton’s laws of motion, static and dynamic equilibrium of particles, work and energy, impulse and momentum, torque and rotational equilibrium, and elasticity. Course includes three hours of lecture and three hours of laboratory applications.

Entry Level Standards:

Students registering for this course must have a strong background in calculus and trigonometry.

Prerequisite:

MATH 1910

Textbook(s) and Other Course Materials:

Texts: University Physics, by Harris Benson, Revised Edition

Lab Manual: Physics 2010 Lab Manual (Accessible Online)

I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 1    | Lecture: Introduction  
1.1 What is Physics?  
1.2 Concepts, Models, and Theories  
1.3 Units  
1.4 Power of Notations and Significant Figures  
1.5 Order of Magnitude  
1.6 Dimensional Analysis  
1.7 Reference Frames & Coordinate Systems |
| 2    | Lecture: Vectors  
2.1 Scalars and Vectors  
2.2 Vector Addition  
2.3 Components and Unit Vectors  
2.4 Scalar (Dot) Product  
2.5 Vector (Cross) Product  
Lab: Group Experiment 1: Density Measurement |
Test 1

3 Lecture: One-Dimensional Kinematics
  3.1 Particle Kinematics
  3.2 Displacement and Velocity
  3.3 Instantaneous Velocity
  3.4 Acceleration
  3.5 The Use of Areas
  3.6 The Equation of Kinematics for Constant Acceleration
  3.7 Vertical Free-fall
  3.8 Terminal Speed
Lab: Group Experiment 2: Addition of Vectors: Graphical Method

4 Lecture: Inertia and Two-Dimensional Motion
  4.1 Newton's First Law
  4.2 Two-dimensional Motion
  4.3 Projectile Motion
Test 2
Lab: Group Experiment 3: Addition of Vector Forces (The Force Table)

5 Lecture: Continued…
  4.4 Uniform Circular Motion
  4.5 Inertial Reference Frames
  4.6 Relative Velocity
  4.7 The Galilean Transformation
  4.8 Non-uniform Circular Motion
Lab: Group Experiment 4: Measurement of "g", The Acceleration of Gravity

6 Lecture: Particle Dynamics I
  5.1 Force and Mass
  5.2 Newton's Second Law
  5.3 Weight
  5.4 Newton's 3rd Law
  5.5 Applications of Newton's Laws
  5.6 Apparent Weight
Test 3
Lab: Group Experiment 5: Centripetal Force

7 Lecture: Particle Dynamics II
  6.1 Friction
  6.2 Dynamics of Circular Motion
  6.3 Satellite Orbits
Lab: Group Experiment 6 Coeff. Of Kinetic Friction
8 Lecture: Work and Energy
  7.1 Work Done by a Constant Force
  7.2 Work done by a Variable Force
  7.3 Work-Energy Theorem in 1-D
  7.4 Power
  Test 4
  Lab: Group Experiment 7: Newton’s Second Law

9 Lecture: Conservation of Mechanical Energy
  8.1 Potential Energy
  8.2 Conservative Forces
  8.3 Potential Energy and Cons. Forces
  8.4 Potential Energy Function
  8.5 Conservation of Mechanical Energy
  8.6 Mechanical Energy and Non-conservative Forces
  8.9 Gravitational Potential Energy
  Lab: Group Experiment 8: Conservation of Energy

10 Lecture: Linear Momentum
  9.1 Linear Momentum
  9.2 Conservation of Linear Momentum
  9.3 Elastic Collision in One Dimension
  9.4 Impulse
  Test 5
  Lab: Group Experiment 9: Conservation of Linear Momentum

11 Lecture:
  9.5 Comparison of Linear Momentum with Kinetic Energy
  9.6 Elastic Collision in 2-D
  9.7 Rocket Propulsion
  Lab: Group Problem Session

12 Lecture: Systems of Particles
  10.1 Center of Mass
  10.2 Center of Mass of Continuous Bodies
  10.3 Motion of Center of Mass
  10.4 Kin. Energy of a Sys. of Particles
  10.5 Work-Energy Theorem for a System of Particles
  10.6 Work Done by Friction
  Test 6
  Lab: Group Experiment 10 Static Equilibrium of a particles (The Crane Boom)

13 Lecture: Rotation About a Fixed Axis
  11.1 Rotational Kinematics
  11.2 Rotational Kinetic Energy, Moment of Inertia
  11.3 Moment of Inertia of Cont. Bodies
  Lab: Group Problem Session

14 Lecture:
  11.4 Conservation of Mechanical Energy
  11.5 Torque
  11.6 Rotational Dynamics of a Rigid Body
  11.7 Work and Power
  Lab: Group Problem Session
II. Course Goals*:

The objective of this course is to familiarize students with the principles of physics as basis for their continuation of studies in Science and Medical profession. At work sites, the graduates often need to work with equipment that work by the virtue of physics principles. Examples are traction equipment, X-ray machines, sonogram, blood pressure measurement devices, etc. The examples and problems selected for the course give the students the necessary knowledge and skills to read and analyze scientific data with proper understanding of the units involved and the type of physical quantity measured. The first few chapters lay down the foundation that is absolutely necessary to understand the physical quantities that appear in later chapters and are often seen on equipment used in medicine or industry.

The course will:

A. explain Metric and American units and systems and perform various conversions between the two, (The gauges at work sites often use both types of units),(V.1 & V.3)

B. Describe the motion of a body and calculate the necessary parameters by using equations of motion in a practical situation,(V.1 & V.4)

C. Analyze force-motion relations in a practical situation,(V.1 & V.4)

D. calculate the work done by a force as well as energy calculations and conversion to heat (calories),(V.1 & V.4)

E. explain different forms of energy and their conversion to each other as well as the Principle of Conservation of Energy in practical situations at work sites,(V.1, V.2, V.3,& V.4)

F. apply the laws of conservation of energy and momentum, (V.2, V.3,& V.4)

G. calculate the parameters involved in the motion of a rotating object such as particle separators (centrifugal separating devices),(V.2 & V.4)

H. apply the laws of fluid pressure and density to measure the necessary parameters in a practical situation at work, (V.1 & V.3)

I. make temperature measurements in different scales and convert and use them for heat and energy calculations with or without phase change,(V.3)

J. apply the equations for thermal expansion of solids, liquids, and gases, (V.3)

K. Describe oscillatory motion by measuring wavelength, amplitude, and the phase of motion of mechanical waves such as sound, (V.1 & V.3)

L. apply the knowledge of sound parameters such as frequency, wavelength, and in interpreting the signals on measurement devices in sonography and ultrasound, (V.3)

M. apply the conditions of static equilibrium to find the forces acting on an object in a given situation, (V.1 & V.3) and

N. use the concept of torque of a force to analyze the static equilibrium of a rigid body. (V.3)

Roman numerals after course goals reference the stipulated outcomes of Natural Science programs under General Education Goals.

III. Expected Student Learning Outcomes*:
The student will be able to:

1. apply the physics concepts to theoretical and practical situations (A through K),
2. estimate an unknown parameter in a given practical situation by using the physics principles involved, (B, D, E, F, G, H, and I),
3. recognize and identify the use of equipment and machines from the units used in their gauges, (A),
4. master energy calculations to estimate energy requirement and feasibility in a given situation, (D, E, and F),
5. perform necessary conversion between Metric and non-metric units and systems (A),
6. apply the kinematics equations to describe motion, (B and C),
7. apply the kinetics equation in force-motion situations (B and C),
8. calculate the work done, energy involved, and energy conversions in a given problem (D, E, and F),
9. solve problems involving circular motion as well as torque, energy, and momentum calculations (E, F, and G),
10. solve temperature and heat problems with or without phase change, (I),
11. solve problems involving heat effect and thermal expansion in solids, fluids, & gases (J),
12. solve problems in oscillatory motion in order to find the parameters involved (K and L),
13. solve and analyze fluid pressure, air pressure, and density problems (H),
14. apply a vector approach where vector quantities are involved (M),
15. resolve a vector into two components graphically and analytically (M), and
16. apply force and torque equilibrium concepts in solving rigid-body problems (M, N, and O).

* Capital letters after Expected Student Learning Outcomes reference the course goals listed above.

IV. Evaluation:

A. Testing Procedures:
Students are primarily evaluated on the basis of test/quiz type assessments and homework as outlined on the syllabus supplement distributed by the instructor. The following formula is used to evaluate the course grade:

\[
\text{Course Grade} = (0.75) \times (\text{Theory Grade}) + (0.25) \times (\text{Lab Grade})
\]

\[
\text{Theory Grade} = 0.80 \times (\text{Tests + Quizzes + H.W.}) + 0.20 \times (\text{Comprehensive Final})
\]

\[
= (80\%) \quad (10\%) \quad (10\%)
\]

The number of tests vary from 5 to 7 at the discretion of instructor.
The percentages given for tests, quizzes, and homework may vary depending on the instructor.

B. Laboratory Expectations:

**Laboratory Grade** = (the sum of reports grades) / (the number of the reports).

10 experiments* are designed for the course. Each experiment requires a report that must be at least spell-checked. Procedures for a standard lab report will be given by your instructor. To avoid a ZERO Laboratory Grade, at least 6 reports must be turned in. No late lab report(s) will be accepted and there are No Lab Make-ups.

C. Field Work:

Site Visits: The necessary site visits will be announced as the arrangements are made. Evaluation will be based on attendance as well as the visit report.

D. Other Evaluation Methods:

N/A

E. Grading Scale:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>91-100</td>
<td>A</td>
</tr>
<tr>
<td>87-91</td>
<td>B+</td>
</tr>
<tr>
<td>81-87</td>
<td>B</td>
</tr>
<tr>
<td>77-81</td>
<td>C+</td>
</tr>
<tr>
<td>70-77</td>
<td>C</td>
</tr>
<tr>
<td>60-70</td>
<td>D</td>
</tr>
</tbody>
</table>

V. Policies:

A. Attendance Policy:

Pellissippi State expects students to attend all scheduled instructional activities. As a minimum, students in all courses (excluding distance learning courses) must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course. Individual departments/programs/disciplines, with the approval of the vice president of the Learning Division, may have requirements that are more stringent. In very specific circumstances, an appeal of the policy may be addressed to the head of the department in which the course was taken. If further action is warranted, the appeal may be addressed to the vice president of Academic Affairs.

B. Academic Dishonesty:
Academic misconduct committed either directly or indirectly by an individual or group is subject to disciplinary action. Prohibited activities include but are not limited to the following practices:

- Cheating, including but not limited to unauthorized assistance from material, people, or devices when taking a test, quiz, or examination; writing papers or reports; solving problems; or completing academic assignments.
- Plagiarism, including but not limited to paraphrasing, summarizing, or directly quoting published or unpublished work of another person, including online or computerized services, without proper documentation of the original source.
- Purchasing or otherwise obtaining prewritten essays, research papers, or materials prepared by another person or agency that sells term papers or other academic materials to be presented as one’s own work.
- Taking an exam for another student.
- Providing others with information and/or answers regarding exams, quizzes, homework or other classroom assignments unless explicitly authorized by the instructor.
- Any of the above occurring within the Web or distance learning environment.

C. Accommodations for disabilities:

Students who need accommodations because of a disability, have emergency medical information to share, or need special arrangements in case the building must be evacuated should inform the instructor immediately, privately after class or in her or his office. Students must present a current accommodation plan from a staff member in Services for Students with Disabilities (SSWD) in order to receive accommodations in this course. Services for Students with Disabilities may be contacted by going to Goins 127, 132, 134, 135, 131 or by phone: 539-7153 or TTY 694-6429. More information is available at http://www.pstcc.edu/sswd/.

D. Other Policies:

**Final Exam:** Final Exam must be taken during the Final Exam Week. No early Final Exam will be given.

**Lab Reports:** No late lab report will be accepted and there are No Lab Make-ups