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 is a continuation of Mechanics and Heat I. It covers rigid body equilibrium, periodic motion, fluid mechanics, heat and thermodynamics, ideal gas behavior, oscillatory motion, and acoustics. 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:

PHYS 1310

Co-requisite:

MATH 1920

Textbook (s) and Other Course Materials:

*University Physics*, by Harris Benson, Revised Edition.

*Physics 2010 Lab Manual* plus a few handouts.

I. Week/Unit/Topic Basis:

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<th>Week</th>
<th>Topic</th>
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<td>12.1 The Torque Vector</td>
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<td>12.2 Angular Momentum</td>
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<td>12.8 Spin and Orbital Angular Momentum</td>
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<td>12.9 Gyroscopic Motion</td>
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<td><strong>Test 1</strong></td>
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<td>Group Experiment #1</td>
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<td>Newton’s Second Law Applied to Rotational Motion</td>
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<td>3</td>
<td><strong>Chapter 13, Gravitation</strong></td>
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<td>13.1 Newton’s Law of Gravitation</td>
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Chapter 14, Solids and Fluids
14.1 Density
14.2 Elastic Moduli
14.3 Pressure in Fluids
14.4 Archimedes’s Principle
14.5 The Equation of Continuity
14.6 Bernoulli’s Equation

Test 2
Group Experiment #3 Center of mass

Chapter 15, Oscillations
15.1 Simple Harmonic Oscillation
15.2 The Block-Spring System
15.3 Energy in Simple Harmonic Notion
15.4 Pendulum
Group Experiment #4
Archimedes’ Principle
Buoyancy

Test 3
Group Experiment #5 Hooke’s Law

Chapter 16, Mechanical Waves
16.1 Wave Characteristics
16.2 Superposition of Waves
16.3 Speed of a Pulse on a String
16.4 Reflection and Transmission
16.5 Traveling Waves

Test 3
Group Experiment #6

Chapter 16, Continued…
16.6 Traveling Harmonic Waves
16.7 Standing Waves
16.8 Resonant Standing Waves on a String
16.9 The Wave Equation
16.10 Energy Transport on a String
16.11 Velocity of Waves on a String
Group Experiment #6
Speed of Transverse Waves (In Stretched Strings)

Chapter 17, Sound
17.1 The Nature of Sound Waves
17.2 Resonant Standing Sound Waves
17.3 The Doppler Effect
17.4 Interference 1 Time: Beats
17.5 Velocity of Longitudinal Waves in a Fluid
17.6 Sound Intensity

Test 4
Chapter 18, Temperature, Thermal Expansion, and Gas Law
18.1 Temperature
18.2 Temperature Scales
18.3 The Zeroth Law of Thermodynamics
18.4 The Equation of State of an Ideal Gas
18.5 Constant-Volume Gas Thermometer
18.6 Thermal Expansion

Chapter 19, First Law of Thermodynamics
19.1 Specific Heat
19.2 Latent Heat
19.3 The Mechanical Equivalent of Heat
19.4 Work in Thermodynamics
19.5 First Law of Thermodynamics

Chapter 19, Continued...
19.6 Application of The First Law of Thermodynamics
19.7 Ideal Gases
19.8 Speed of Sound
19.9 Heat Transport

Chapter 20, Kinetic Theory
20.1 The Model of an Ideal Gas
20.2 Kinetic Interpretation of Pressure
20.3 Kinetic Interpretation of Temperature
20.4 Specific Heats of an Ideal Gas

Chapter 21, Entropy and The Second Law of Thermodynamics
21.1 Heat Engine, Kelvin-Planck Statement of the 2nd Law
21.2 Refrigerators and the Clausius Statement of the 2nd Law
21.3 Equivalence of the Kelvin-Planck & Clausius Statements
21.4 Reversible and Irreversible Processes
21.5 The Carnot Cycle
21.6 The Gasoline Engine (Otto Cycle)
21.7 Entropy
21.8 Entropy and The Second Law
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. On this basis, after finishing this course, students will be able to:

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, and 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:

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

\[
\text{Theory Grade} = 0.80 \times (\text{Tests + Quizzes + H.W.}) + 0.20 \times (\text{Comprehensive Final})
\]
The number of tests may vary from 5 to 7. The percentages given for tests, quizzes, and homework may vary depending on the instructor.

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

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 of attendance as well as the visit report.

D. Other Evaluation Methods:

N/A

E. Grading Scale:

(91-100: A), (87-91: B+), (81-87: B), (77-81: C+), (70-77: C), and (60-70: D)

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.pstec.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