

PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

ELEMENTS OF PHYSICS I W/LAB
PHY 2210

Class Hours: 3.0

Credit Hours: 4.0

Laboratory Hours: 3.0

Date Revised: Spring
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Catalog Course Description:

This Course includes the basic principles of physics with their applications in pre-medical, -dental, -pharmacy, and -veterinary programs and covers mechanics, heat, and wave motion including sound. Course includes 3 hours of lectures and 3 hours of laboratory applications.

Entry Level Standards:

Students registering for this course must have recently finished a pre-calculus course and have a good background in trigonometry.

Prerequisites:

MTH 1020 or MTH 1000 & 1010

Textbook(s) and Other Reference Materials Basic to the Course:

Physics by Cutnell & Johnson, 4th Edition, Wiley 1997.

Physics Laboratory Experiments, Jerry Wilsin, 5th Edition, D.C. Heath and Company, 1986.

I. Week/Unit/Topic Basis:

Week	Topic
1	Lecture: 1.1 thru 1.3, System of Units 1.5 Scalars and Vectors 1.6 Vector Addition and Subtraction 1.7 Vector Components 1.8 Vector Addition by Use of Components Lab: Ch. 1 group problems session
2	Lecture: 2.1 Displacement 2.2 Speed and Velocity; 2.3 Acceleration; 2.4 Kinetics Equations 2.5 Applications of 2.4 2.6 Freely Falling Bodies Lab: Group experiment 1: Density Measurement, (Exp. 2 in the Lab Manual) Also, Chapter 2, group problems session
3	Lecture: 3.1 2-D Displacement, Vel. & Accel. 3.2 Equations of Kinematics in 2-D

- 3.3 Projectile Motion
 3.4 Relative Velocity
 Test 1, 20-30 minutes
 Lab: Group Experiment 2: Measurement of the Acceleration of Gravity(g), (Exp. 4 in Lab Manual) Ch. 3 group problems session
- 4 Lecture: 4.1 The Concept of Force and Mass
 4.2 Newton's 1st Law of Motion
 4.3 Newton's 2nd Law of Motion
 4.4 The Vector Nature of 2nd Law
 4.5 Newton's 3rd Law of Motion
 Lab: Group Experiment 3: Experimental Addition of Vectors by Using a Force Table, (Exp. 5 in Lab Manual), Ch. 4 group problems session
- 5 Lecture: 4.7 and 4.8: The Gravit.& Normal Forces
 4.9 Frictional Force
 4.10 The Tension Force
 4.11 and 4.12: Equilibrium of Forces
 Lab: Ch. 4 group problems session
- 6 Lecture: 5.1 Uniform Circular Motion
 5.2 Centripetal Acceleration
 5.3 Centripetal Force
 5.4 Banked Curves
 5.5 Satellites in Circular Orbits
 5.6 Vertical Circular Motion
 5.6 Power, Chapter Review.
 Test 2, 20-30 minutes
 Lab: Group Experiment 4: Newton's 2nd Law (Exp. 6 in Lab Manual), Ch. 4 and Ch. 5 group problems session
- 7 Lecture: 6.1 Work Done by a Constant Force
 6.2 The Work-Energy Theorem and K.E.
 6.3 Gravitational Potential Energy
 6.5 The Conserv. of Mechanical Energy
 6.7 Power
 6.9 Work done by a variable force
 Lab: Group Experiment 5: Coefficient of Friction (Exp. 10 in Lab Manual), Ch.6 group problems session
- 8 Lecture: 7.1 The Impulse-Momentum Theorem
 7.2 Conservation of Linear Momentum
 7.3 Collision in One Dimension
 Lab: Group Experiment 6: Conservation of Energy (Exp. 11 in Lab Manual), Ch. 7 group problems session
- 9 Lecture: 8.1 Angular Displacement
 8.2 Angular Velocity and Acceleration
 8.3 Rotational Kinematics
 8.4 Angular and Tangential Variables
 8.5 Centripetal and Tangential Accel.
 8.6 Rolling Motion
 Test 3, 20-30 minutes
 Lab: Group Experiment 7: Centripetal Force (Exp. 9 in Lab Manual), Ch.8 group problems session

- 10 Lecture: 9.1 Torque Concept
 9.4 2nd Law for Rotation about an Axis
 Lab: Ch.9 group problems session
- 11 Lecture: 10.3 Simple Harmonic Motion(SHM)
 10.4 SHM and the Reference Circle
 Lab: Ch.10 group prob. session
- 12 Lecture: 11.1 Mass Density
 11.2 Pressure
 11.3 Pressure and Depth in Static Fluids
 11.5 Pascal's Principle
 11.6 Archimedes' Principle
 Test 4, 20-30 minutes
 Lab: Ch. 11 group prob. session
- 13 Lecture: 12.1-3 Temp. Scales & Thermometers
 12.4-5 Thermal Expansion
 12.6 Heat and Internal Energy
 12.7 Heat and Temperature Change
 12.8 Heat and Phase Change
 Lab: Group Experiment 8: Archimedes' Principle, Specific Gravity Measur. (Exp. 22 in Lab Manual), Ch. 12 group prob. session
- 14 Lecture: 14.1 The Mole Concept & Avogadro's No.
 14.2 The Ideal Gas Law
 14.4 Kinetic Theory of Gases
 Lab: Group Experiment 9: Specific Heat Measurement (Exp. 19 in Lab Manual), Ch. 14 group prob. session
- 15 Lecture: 16.1 The Nature of Waves
 16.2 Periodic Waves
 16.3 The Speed of a Wave on a String
 16.4 Equation of a Wave
 16.5 The Nature of Sound
 16.6 The Speed of Sound
 16.10 The Doppler Effect
 Test 5, 20-30 minutes
 Lab: Group Experiment 10: Speed of Sound Air Column Resonance (Exp. 17 in Lab Manual)
- 16 COMPREHENSIVE FINAL EXAM (110 minutes)

II. Course Objectives*:

- 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). I.5, VI.2
- B. Qualitatively describe the motion of a body and quantitatively calculate the necessary parameters by using equations of motion in a practical situation. VI.2-5
- C. Quantitatively analyze force-motion relations in a practical situation. I.5, VI.1-5
- D. Calculate the work done by a force as well as energy calculations and conversion to heat(calories). VI.1-5

- 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. I.5
- F. Apply the laws of conservation of energy and momentum. I.5
- G. Quantitatively calculate the parameters involved in the motion of a rotating object such as particle separators(centrifugal separating devices). VI.1-5
- H. Quantitatively apply the laws of fluid pressure and density to measure the necessary parameters in a practical situation at work. VI.1-5
- I. Make temperature measurements in different scales and convert and use them for heat and energy calculations with or without phase change. I.5
- J. Apply the equations for thermal expansion of solids, liquids, and gases. I.5
- K. Quantitatively assess oscillatory motion by measuring wavelength, amplitude, and the phase of motion of mechanical waves such as sound. I.5
- L. Apply their knowledge of sound parameters such as frequency, wavelength, and intensity in interpreting the signals on measurement devices in sonography and ultrasound. I.5
- M. Apply the conditions of static equilibrium to find the forces acting on an object in a given situation. I.5
- N. Use the concept of torque of a force to analyze the static equilibrium of a rigid body. I.5
- O. Search for the solution to the assigned projects by examining the available software and resources. VII

*Roman numerals after course objectives reference goals of the university parallel program.

III. Instructional Processes*:

Students will:

1. Learn in a cooperative mode by working in small groups with other students and exchanging ideas within each group (or sometimes collectively) while being coached by the instructor who provides assistance when needed. *Communication Outcome, Problem Solving and Decision Making Outcome, Active Learning Strategy*
2. Learn by being a problem solver rather than being lectured. *Problem Solving and Decision Making Outcome, Active Learning Strategy*
3. Explore and (enthusiastically) seek the solutions to the given problems which measures his/her level of accomplishment. *Problem Solving and Decision Making Outcome, Active Learning Strategy*
4. Visit industry sites or will be visited by a person from industry who applies the concepts being learned at his/her work site. *Transitional Strategy*
5. Gradually be given higher- and higher-level problems to promote his/her critical thinking ability. *Problem Solving and Decision Making Outcome, Personal Development Outcome*
6. Be tested more frequently for progress assessment while working independently on test problems. *Problem Solving and Decision Making Outcome*

7. Get engaged in learning processes such as projects, mentoring, apprenticeships, and/or research activities as time allows. *Communication Outcome, Transitional Strategy*
8. Use computers with appropriate software during class or lab as a boost to the learning process. *Information Literacy Outcome, Technological Literacy Outcome*

*Strategies and outcomes listed after instructional processes reference Pellissippi State's goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

IV. Expectations for Student Performance*:

Upon successful completion of this course, the student should be able to:

1. Apply the physics concepts to theoretical and practical situations. A-K
2. Estimate an unknown parameter in a given practical situation by using the physics principles involved. B,D,E,F,G,H,I
3. Recognize and guess 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,F
5. Perform necessary conversion between metric and non-metric units and systems. A
6. Apply the kinematics equations to describe motion. B, C
7. Apply the kinetics equation in force-motion situations. B,C
8. Calculate the work done, energy involved, and energy conversions in a given problem. D, E, F
9. Solve problems involving circular motion as well as torque, energy, and momentum calculations. E,F, 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, 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
16. Apply force and torque equilibrium concepts in solving rigid-body problems. M,N

*Letters after performance expectations reference the course objectives listed above.

V. 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:

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

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

(80%) (10%) (10%)

The number of tests vary from 5 to 7 at the discretion of instructor.

The quizzes and homework percentages may vary depending on the instructor.

B. Laboratory Expectations:

Ten experiments are designed for the course. Each experiment requires a word-processed report which must be at least spell-checked. Other procedures for a standard lab report will be given by your instructor. No late lab report will be accepted and there are NO lab make-ups.

$$\text{Lab Grade} = (\text{the sum of report grades}) / (\text{the number of the reports})$$

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	77-81 : C+
87- 91 : B+	70-77 : C
81- 87 : B	60-70 : D

VI. Policies:

Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course.