PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

MECHANICS & HEAT W/ LAB II
PHY 1320

Class Hours: 3.0 | **Credit Hours: 4.0**

Laboratory Hours: 3.0 | **Date Revised: Spring 01**

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 3 hours of lecture and 3 hours of laboratory applications.

Entry Level Standards:

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

Prerequisite:

PHY 1310

Corequisite:

MATH 1420

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

University Physics, Models and Applications, by William P. Crummett and Arthur B. Western
Physics Lab Experiments, by Jerry D. Wilson, 5th edition

I. Week/Unit/Topic Basis:

Week	**Topic**
1	Leture: Static Equilibrium & Rolling Objects (12.1 Static Equilibrium, 12.2 Rotation and Transl. (No-slip), 12.3 Rotation and Transl. (With slip)) Lab: Group Problems Session
2	Vector Description of Rotational Mot. (13.1 Torque Vector, 13.2 Angular Velocity & Accel. Vectors, 13.3 Vector Relations Between L & Lab: Group Experiment #1, Newtons 2nd Law for Rotational Motion
3	Lecture: Oscillations (Simple Harmonic Motion), (14.1 Kinematics of SHM, 14.2 The Dynamics of SHM) Test 1 Lab: Group Experiment #2, Simple Harmonic Motion
4	Lecture: Oscillations (Simple Harmonic Motion)14.4 Uniform Circular Motion and SHM, 14.5 Damped and Driven Oscillations Lab: Group Problems Session

5	Lecture: One-dimensional Waves (15.1 Introduction, 15.2 Waves Traveling on a String, 15.3 Wave Veocity on a String, 15.4 Energy Transperted by Sine-Waves) Lab: Group Experiment #3, Vibrating String
6	Lecture: One-dimensional Waves (15.5 Superposition and Interference, 15.6 The Wave Equation) Test 2 Lab: Group Problems Session
7	Lecture: Solids, Liquids, and Gases (16.1 States of Matter, 16.2 Stress, Strain, and Elastic Moduli, 16.3 Density and Pressure, 16.4 Fluid Statics) Lab: Group Experiment #4, The Hooke's Law
8	Lecture: Solids, Liquids, and Gases (16.5 Newton's Universal Law of Gravity, 16.6 Fluid Dynamics, 16.7 Dynamic Viscosity) Lab: Group Experiment #5, Archimede's Principle
9	Lecture: Sound (17.1 Models for Sound Waves in a Gas, 17.2 The velocity of Sound, 17.3 Harmonic Waves in Air, 17.4 Sound Intensity and Intensity Level, 17.5 Sources of Sound, 17.6 The Doppler Effect) Test 3 Lab: Group Experiment #6, Speed of Sound (Air Resonance Tube)
10	Lecture: Thermodynamics and Kinetic Theory (18.1 Temperature, 18.2 Thermal Expansion, 18.3 Heat Energy Transfer Mechanics) Lab: Group Experiment #7, Thermal Expansion Coefficient
11	Thermodynamics and Kinetic Theory (18.4 Heat Capacity and Latent Heat, 18.5 The Equation of State) Test 4 Lab: Group Experiment #8, Heat Capacity Measuerment
12	Lecture: Thermodynamics I: Processes & 1st Law (19.1 Equilibrium, Zeroth Law,& Processes, 19.2 Work, 19.3 The 1st Law of Thermodynamics) Lab: Group Experiment #9, Absolute Temperature: Gas Volume Expansion,
13	Lecture: Thermodynamics I: Processes & 1st Law (19.4 Specific Thermodynamics Processes, 19.5 Cyclic Processes) Lab: Group Problems Session
14	Lecture: Thermodynamics II: The 2nd Law (20.1 The 2nd Law and Heat Engines, 20.2 The Carnot Cycle, 20.3 Refrigerators and Heat Pumps, 20.4 The Abs. Temp. Scale & The 3rd Law) Test 5 Lab: Group Experiment # 10, Gas Expansion at Constant Volume
15	Lecutre: Thermodynamics II: The 2nd Law (20.5 General Cyclic Processes, 20.6 A Formal Def. of State Variables, 20.7 Entropy: A State Variable, 20.8 Entropy Changes for Irrev. Processes, 20.9 Entropy and Disorder Lab: Group Problems Session
16	Comprehensive Final Exam

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. Analyze the equilibrium of rotating, translating, and rolling objects. I.5

C. Use a vector approach in the description of rotational motion. I.5

D. Realize any periodic and oscillatory motion and be able to determine and calculate the variations of the variables involved. I.5, VI.1-5

E. Relate the oscillatory motion to wave motion and quantitatively calculate the variables involved in standing and traveling waves. I.5, VI.1-5

F. Calculate wave energy and describe wave interference and superposition VI.1-5

G. Explain different phases and properties of matter: solid and fluid mechanical and gas dynamics states I.5

H. Quantitatively analyze sound, its velocity in matter, harmonic waves in strings and pipes, resonance, beats, and the Doppler effect. I.5, VI.1-5

I. Explain temperature, heat, thermal expansion, heat energy transfer mechanisms, heat capacity and latent heat and the equation of state for gases. I.5

J. Apply the four laws of thermodynamics to different selected processes and cycles. I.5

K. Explain the importance of entropy and the calculation of entropy losses in selected thermodynamic processes. I.5

L. 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, H, J, K

3. Recognize and guess the use of equipment and machines from the units used in their gauges. A-K

4. Calculate wave energy to estimate energy requirement and feasibility in a given situation. F

5. Perform necessary conversion between metric and non-metric units and systems. A

6. Apply equilibrium equations to rotational motion situations. B

7. Apply the kinetics equation in torque-motion situations. B

8. Calculate the work done, energy involved, and energy conversions in a given problem involving rotational motion. B

9. Apply a vector approach in solving simple rotational motion problems. C

10. Apply the general equation of oscillatory motion to a practical situation in order to calculate and/or measure the necessary parameters. D

11. Apply the one-dimensional wave equation to determine the parameters involved in the motion of a wave such as radio waves. D, E

12. Apply wave energy calculations to determine the wave energy transported to a given point in space. F

13. Solve problems involving mechanical properties of solids, fluids, and gases. G

14. Apply the wave equation and properties of matter to problems involving sound propagation. H

15. Apply the equations involving heat calculation due to a temperature change as well as a phase change. I

16. Apply the laws of thermodynamics to selected processes. J

17. Solve simple entropy change problems. K

*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:

Course Grade = (0.75) x (Theory Grade) + (0.25) x (Lab Grade)

Theory Grade = 0.80 (Tests + Quizzes + H.W.) + 0.20 (Comprehensive Final)
(80%) (10%) (10%)

The number of tests vary from 5 to 7 at the discretion of instructor.
The quizzes and homework percentages depends 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.

Lab Grade = (the sum of report grades) / (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.