PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

MECHANICS & HEAT W/ LAB I
PHYS 1310

Class Hours: 3.0 Credit Hours: 4.0
Laboratory Hours: 3.0 Revised: Fall 09

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 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:

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>
<tbody>
<tr>
<td>1</td>
<td>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 &amp; Coordinate Systems</td>
</tr>
<tr>
<td>2</td>
<td>Lecture: Vectors 2.1 Scalars and Vectors 2.2 Vector Addition 2.3 Components and Unit Vectors 2.4 Scalar (Dot) Product</td>
</tr>
</tbody>
</table>
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: Vector Addition: 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 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),(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 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 (Active Learning Strategy),

2. learn by being a problem solver rather than being lectured (Active Learning Strategy),

3. explore and seek solutions to given problems that measures his/her level of accomplishment (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 (Active Learning Strategy),

6. search for the solution to the assigned projects by examining the available software and resources (Transitional Strategy),

7. get engaged in learning processes such as projects, mentoring, apprenticeships, and/or research activities as time allows (Transitional Strategy),

8. use computers with appropriate software during class or lab as a boost to the learning process (Technological Literacy Outcome)

*Strategies and outcomes listed after instructional processes reference TBR’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-N

2. estimate an unknown parameter in a given practical situation by using the physics principles involved, B, D, E, F, H, J, K and N

3. recognize the use of equipment and machines from the units used in their gauges, A-N

4. perform conversions between metric and non-metric units, A

5. apply the equilibrium equations to rectilinear motion, B
6. apply the equilibrium equations to rotational motion, J, K, L

7. apply the kinetics equation in torque-motion situations, J, K, L

8. calculate the work done, energy involved, and energy conversions in a given problem involving rectilinear motion, E, F, G

9. calculate the work done, energy involved, and energy conversions in a given problem involving rotational motion, J, K, L

10. calculate the rotational kinetic energy and angular momentum for rotating objects, J

*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)

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:

Ten experiments are designed for the course. Each experiment requires a report that must be at least spell-checked. Other 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.

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:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</th>
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<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>70-77</td>
<td>C</td>
</tr>
<tr>
<td>60-69</td>
<td>D</td>
</tr>
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VI. Policies:

A. 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. Individual departments/programs/disciplines, with the approval of the vice president of Learning, may have requirements that are more stringent.

B. Academic Dishonesty:

Plagiarism, cheating, and other forms of academic dishonesty are prohibited. Students guilty of academic misconduct, either directly or indirectly through participation or assistance, are immediately responsible to the instructor of the class. In addition to other possible disciplinary sanctions which may be imposed through the regular Pellissippi State procedures as a result of academic misconduct, the instructor has the authority to assign an F or a zero for the exercise or examination or to assign an F in the course.

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 134 or 126 or by phone: 694-6751 (Voice/TTY) or 539-7153. More information is available at www.pstcc.edu/departments/swd/.