San Bernardino Valley College
Curriculum Approved: FA00

I. CATALOG DESCRIPTION

A. Division: Science
Department: Physics
Course ID: **Physic 200**
Course Title: **Physics I**
Units: 6
Lecture: 4 hours per week
Laboratory: 5 hours per week

Prerequisites: PHYSIC 101 and ENGL 015 or eligibility for ENGL 101
Prerequisite or Corequisite: MATH 250
Advisory: Students who have successfully completed High School Physics may substitute that for the Physics prerequisite listed above.

B. Course Description:
A calculus based physics course covering mechanics, waves, fluids, and thermodynamics. This course is designed to satisfy the lower division physics requirement for majors in physics, engineering, astronomy, chemistry, geology, computer science and mathematics.

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II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS: Upon successful completion of the course, the student should be able to:

A. Read and critically evaluate scientific literature involving basic concepts
B. Apply basic scientific principles to new situations
C. Identify and use the fundamental concepts of kinematics
D. Recognize and use Newton's Laws of Motion and Gravitation
E. Explain the connections between dynamics, energy, and momentum
F. Apply the basic laws of conservation of energy and momentum
G. Use the concepts of kinematics, dynamics, and energy to understand simple harmonic motion
H. Identify the fundamental properties of fluids and the laws governing their behavior
I. Describe and solve basic problems involving wave motion
J. Explore thermodynamics, including the concepts of temperature, heat, and thermal energy
K. Apply the calculus concepts of differentiation and integration of algebraic and trigonometric functions to a variety of physical situations..
L. Support the above learning objectives through directed laboratory work.

IV. CONTENT: *(Laboratories listed are representative.)*

A. Introduction
1. measurement
2. using equations
3. using trigonometry
4. using calculus
- *lab - diameter vs. circumference*
- *lab - the graphing calculator*

B. Vectors
   1. addition and subtraction
   2. components
   3. static equilibrium
   - *lab - vector addition*
   - *lab - static equilibrium*

C. Kinematics
   1. rate of change
   2. limits
   3. derivative of algebraic functions
   4. velocity
   5. acceleration
   6. integral of algebraic functions
   - *lab - free fall*

D. Dynamics
   1. inertia
   2. Newton's laws
   3. friction
   4. gravity
   - *lab -Atwood machine*
   - *lab - friction*

E. Circular motion
   1. kinematics
   2. dynamics
   - *lab - circular motion*

F. Conservation of Momentum
   1. impulse
   2. collisions
   - *lab - impulse of a water jet*
   - *lab - 2-dimensional collisions*
   - *lab - center of mass*

G. Conservation of Energy
   1. work
   2. line integral
   3. kinetic energy
   4. potential energy
   5. power
   - *lab - conservation of energy*

H. Rotational Motion
   - *lab – rotational inertia*
   - *lab – static equilibrium*

I. Fluids
   1. statics
   2. dynamics
   - *lab - Archimedes Principle*
   - *lab - fluid flow*

J. Oscillations and Waves
1. simple harmonic motion
2. calculus of trigonometric functions
3. wave motion
- *lab -simple harmonic motion*
- *lab - waves in one and two dimensions*

K. Sound
- *lab - sound, resonance, standing waves*

L. Heat and Thermodynamics
1. temperature
2. heat
3. thermal energy
4. change of state
5. thermal energy transfer
6. kinetic theory
7. the laws of thermodynamics
- *lab - calorimetry*
- *lab - change of state*
- *lab - thermal conductivity*
- *lab - thermal expansion*

V. METHODS OF INSTRUCTION:

Instructors will include some or all of the following instructional components:

A. Classroom lecture. May be accompanied by activities such as demonstrations, video, film, and computer simulations.
1. Specific reading assignments to reinforce and extend classroom presentations.
2. Demonstration experiments evoking discussion and problem solving.
3. Computer aided instruction.
4. Written assignments involving the solution of problems illustrative of various physical situations requiring critical thinking skills.

B. Laboratory experimentation. Students work toward specific goals of observation and analysis.
1. Students write and summarize their laboratory observations.
2. Writing includes background, data analysis, and documentation of principles and apparatus.

C. Other written assignments such as library research including analysis of current popular scientific literature.

VI. TYPICAL ASSIGNMENTS:

A. LECTURE ASSIGNMENT

- **Forces:**

We study Newton's Three Laws of Motion. The concept of net force leads us to a special way of adding arrows called vectors. We also introduce two special forces: weight and friction.

Read: Chapter 4 - Forces

Learning Goals: You should understand:

What is meant by inertia.
Newton's First Law.
The concept of momentum: $\boldsymbol{p} = m\boldsymbol{v}$.
Newton's Second Law in the general form $\boldsymbol{F}_{net} = \Delta\boldsymbol{p}/\Delta t$, and $\boldsymbol{F}_{net} = m\boldsymbol{a}$ as a special case.
Newton's Third Law
What is meant by net force, and be able to find the net force for a given set of forces.
The units used for mass and force.
The concept of weight.

How friction affects the motion of objects.
The application of Newton's Laws to simple situations.

End of Chap. Exercises: (Examples of 10 – 15 assigned exercises)

1. Two forces $\boldsymbol{F}_1$ and $\boldsymbol{F}_2$ act on a 5.00 kg mass. If F_1 = 20.0 N and F_2 = 15.0 N, find the acceleration of the mass if (a) the forces are at right angles to each other, and (b) the angle between the forces is 60^o.
2. A car is traveling at 50.0 mi/h on a horizontal highway. If the coefficient of friction between tires and road is 0.10, what is the minimum stopping distance?

B. LAB ASSIGNMENT

Atwood Machine

An Atwood machine is, at its simplest, two masses hung on either side of a pulley. Mass is transferred from one side of the pulley to the other, keeping the total mass constant while changing the net force on the system.

1. Graph F_{net} vs t, with time on the horizontal axis and force on the vertical axis.
2. Plot a graph of F_{net} vs v_f , with v_f on the horizontal axis.
3. Graph F_{net} vs. a (with acceleration on the horizontal axis), this should be a straight line graph.
4. Describe the results of the analysis in parts 1, 2, and 3. Include the physical interpretation of the slope and the intercept in the summary.

VII. EVALUATION:

A. Methods of Evaluation:

Grading may be comparative (scaling, curve) or based on an absolute standard. Questions are designed to evaluate student comprehension of the learning goals enumerated in item IV above. Students will be asked to identify basic principles, recognize and apply common terminology, and apply fundamental knowledge to real world situations.

Methods of evaluation will vary with the instructor, and may include some or all of the following components.

1. Objective tests which may include true-false, multiple choice, and matching items.
2. Subjective tests which may include completion items and essay questions.
3. Laboratory performance
4. Problem solutions
5. Projects
6. Written assignments as described in V above.

B. Frequency of evaluation:

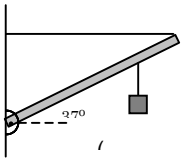
1. There are typically three to five exams during the semester.
2. Other, more frequent evaluation techniques, such as quizzes, may be utilized.

C. Typical exam questions:

1. A ball is thrown upward with an initial velocity of 25 m/s from the edge of a cliff.
   Show all work for credit.
   a. When does the ball reach it highest point?
   b. What is the maximum height reached by the ball?
   c. At what time(s) is the ball 15 m above its starting point?
   d. Where is the ball 6 s after it is thrown?

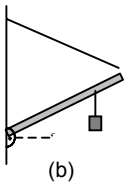
2. Write the equation describing the law of gravitation. Draw a diagram labeled with the appropriate symbols used in your equation. Describe in words the law of gravitation.

3. A uniform plank of weight W_P = 200 N and length L = 2 m is hinged at a wall, and held by a cable as shown in the figure. A weight W = 100 N is hung from the plank at a distance x = 1.5 m from the hinge. Find



a) the tension in the cable

b) If the cable is attached as shown in figure b, will the tension be the same, greater, or smaller than in part (a)? Explain your reasoning.



(b)

c) If the plank is pulled up to a steeper angle as shown in figure (c), will the tension be the same, greater, or smaller than in part (a)? Explain your reasoning.

(c)

VIII. TYPICAL TEXT(S):

A. Giancoli, Physics for Engineers and Scientists, 2000, Prentice-Hall
B. Serway, Principles of Physics, 1997, Harcourt
C. Serway and Belchner, Physics for Scientists and Engineers, 5th ed., 2000, Harcourt
D. Tipler, Physics for Engineers and Scientists, 4th ed.,1999, Worth

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

Graphing Calculator, Blank quadrille notebook