Mt. San Jacinto College
Integrated Course Outline of Record

Form B

Submitted by: Anthony DiMauro **Date:** 05/14/2020

Department	Subject	Course Number	Title
Physics	Physics PHY	101	Basic Physics: Energy and Motion

Units/Hours

Each lecture unit requires 1 hour per week of class time, and 2 hours per week of study outside of class.
Each laboratory unit requires 3 hours per week of class time.
Each activity unit requires 2 hours per week of class time and 1 hour per week of study outside of class.

Lecture Units	Lab Units	Total Units
3.00	1.00	4.00
Lecture Contact Hours	**Lab Contact Hours**	**Total Contact Hours**
48.00 - 54.00	48.00 - 54.00	96.00 - 108.00
Lecture Homework Hours	**Lab Homework Hours**	
96.00 - 108.00	0	

Stand Alone:

Program Applicable

AA/AS Degree General Ed Breadth Area(s):

A NATURAL AND PHYSICAL SCIENCES

General Education Justification:

Physics 101 examines and analyzes the properties of the physical universe and their interactions (GELO 1,3). To do this it must examine the intereactions of energy, matter, and motion, on scales from the atomic level to the size of the observable universe, and ranging from everyday siutations to theoretical and experimental scientific settings (GELO 1,3). The study of physics enables our understanding of natural phenomena, and is the basis for the fields of biology, chemistry, geology, and astronomy (GELO 5). Emphasis is placed on understanding and use of the scientific method which involves proposing and testing hypotheses using experimental methodology, college-level mathematics, and computer simulations to establish an understanding of the physical universe and our place in it (GELO 2,3,4,5,6). The content of this course, as outlined above, is consistent with the intent of General Education Area A: Natural and Physical Sciences.

Maximum Enrollment: 32

Maximum Enrollment Justification:

	Justification:
Grading Method:	**Letter Grade or P/NP**
TOP code:	**1902.00**

Can be Taken **1** **time(s) for credit** (max 4)

- ☐ - Visual or Performing Arts course that is required to meet major requirements for UC/CSU
- ☐ - Intercollegiate athletics course
- ☐ - Academic/vocational competition course

Catalog Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**75 words** or less in gray box below).

This course facilitates the study of various topics in physics including the kinematics of motion, forces, work and energy, circular motion, fluids, temperature and heat, thermodynamics, waves and sound, while focusing on the student's development of technical problem solving skills, vocabulary and the ability to read and understand scientific literature.

Schedule Description:

(Please do not refer to transferability or degree, certificate, or employment concentration applicability. Please only describe the course).
(**25 words** or less in gray box below).

This course provides a non-calculus based introduction to the basic physics of motion- heat and fluid dynamics.

Need for the course:

The course satisfies the science requirement for students seeking to satisfy general education science requirements for an AA/AS in General Education. The course transfers to both UC/CSU.

Prerequisite(s):

Prerequisites go through a separate approval process. See Forms E1-E6 for details.
(For further clarification, contact the Prerequisite Subcommittee)

- MATH 105 with a Grade of C or better.

Corequisite(s):

Corequisites go through a separate approval process. See Forms E1-E6 for details.

-none-

Recommend Preparation:

Recommended Preparation goes through a separate approval process. See Forms E1-E6 for details.

-none-

Other Enrollment Criteria:

-none-

Learning Objectives:

(please number each objective and express in behavioral terms)
Upon the completion of the course the student will be able to do the following:

1. Analyze motion in one- and two-dimensional situations with the use of vectors
2. Evaluate Newton's laws of motion and apply them to solving problems involving force
3. Compare and contrast kinetic and potential energies and argue how they are related to work
4. Examine the role of impulse in causing a change in momentum and its roles in conservation of momentum and analyzing collisions
5. Investigate rotational equilibrium and dynamics; and the role of Newton's law of gravity in assessing the motion of extended objects
6. Examine the properties of solid matter and fluids including their static and dynamic behaviors
7. Analyze thermal processes utilizing the laws of thermodynamics
8. Investigate simple harmonic motion and wave behavior including sound waves
9. Collect precise measurements using simple instruments including but not limited to meter sticks, timers, scales and calipers
10. Operate computer based data acquisition systems
11. Analyze and interpret laboratory data using calculator and computer based analytic and graphing applications as needed
12. Compose clear and comprehensive laboratory reports.

Course Content:

(please number the outline of main topics and subtopics)

1. Basic tools of Physics
    1. Units of measures
    2. Dimensional analysis
    3. Vectors and scalars
    4. Basic trigonometry
2. Kinematics
    1. Displacement
    2. velocity
    3. Acceleration
    4. Solving Kinematic problems in 1 and 2 dimensions using trigonometry
3. Dynamics
    1. The concept of force
    2. Inertial mass
    3. Newton's three laws of motion
    4. Static equilibrium
    5. Gravitational force and weight
    6. Solving force problems using trigonometry
4. Work, Energy and Power at Non-Calculus Level
    1. Work done by a force
    2. Work - Energy theorem
    3. Isolated and nonisolated systems
    4. Conservative and nonconservative forces
    5. Potential energy
    6. Stability and equilibrium
5. Momentum and collisions
    1. Linear momentum and its conservation
    2. Impulse and momentum
    3. Collisions
    4. Center of mass
    5. Motion of a system of particles
    6. Solving momentum problems using trigonometry
6. Rotational Motion at a Non-Calculus Level
    1. Rotational kinematics
    2. Relations between rotational and translational quantities

3. Torque and Newton's second law
4. Rotational kinetic energy
5. Angular momentum and its conservation

7. Oscillatory Motion.
    1. Motion of a particle attached to a spring
    2. Mathematical representation of simple harmonic motion at a Non-Calculus Level
    3. Energy considerations in simple harmonic motion
    4. The simple pendulum
    5. The physical pendulum
    6. Damped and forced oscillations
8. Mechanical waves
    1. The wave model
    2. Reflection and transmission of waves
    3. Energy transfer in sinusoidal waves
    4. The Doppler effect
    5. The principle of superposition
    6. Interference of waves
    7. Standing waves
    8. Nonsinusoidal wave patterns
9. Fluid mechanics
    1. Pressure
    2. Buoyant forces and Archimedes's principle
    3. Fluid dynamics
    4. Continuity equation for fluid
10. Thermodynamics - First and second laws, heat engines, entropy

Lab Content:

(please number the outline of main topics and subtopics)

I. Measurments and uncertainty
    1. Significant figures
    2. Error analysis
II. Proper use of simple laboratory equipment
    1. Meter stick
    2. Scales
    3. Calipers
III. The computer based laboratory
    1. Opening data collection programs
    2. Setting up experimental equipment and sensors
    3. Calibrating sensors
    4. Taking data.
    5. Analyzing data
IV. The laboratory report

Methods of Instruction:

Methods of instruction may include, but are not limited to the following:

- **Method:** Lecture
  Integration: Lecture is used to demonstrate and interactively discuss the fundamental laws of physics.
- **Method:** Observation and Demonstration
  Integration: Observation and demonstration are used to analyze problem solving strategies in physics.
- **Method:** Lab Activities
  Integration: Lab experiments of selected physics phenomenon are performed and written reports including error analysis are created.

Methods of Evaluation:

A student's grade shall be determined by the instructor using multiple measures of performance related to the course objectives. Methods of evaluation may include but are not limited to the following:

- **Method:** Homework
  Integration: Quizzes on homework assignments involving similar analysis as in the examinations.
- **Method:** Laboratory Report
  Integration: Reports which demonstrate the student's ability to make precise measurements, analyze the collected data, interpret the results and perform appropriate error analysis in a concise and clear manner.
- **Method:** Exams/Tests
  Integration: Examinations requiring analysis of various physical systems, derivation of a mathematical description of each, solution of the resultant equations and physical interpretation of the result.

Examples of Assignments:

Students will be expected to understand and critique college level texts or the equivalent. Reading and writing, as well as out of class assignments are required. These assignments may include but are not limited to the following:

1. The homework assignment is generally to solve a select few of the problems at the end of each chapter. These problems require analysis of physical situations relevant to the lecture and lab topics, develop the necessary mathematical model describing the situation and then to solve the resultant system of equations. Examples are:
    1. A person is sitting with one leg outstretched so that it makes an angle of 30.0° with the horizontal. The weight of the leg below the knee is 44.5 N with the center of gravity located below the knee joint. The leg is being held in this position because of the force M applied by the quadriceps muscle, which is attached 0.100 m below the knee joint. Obtain the magnitude of M.
    2. What is the radius of a hydrogen-filled balloon that would carry a load of 5750 N (in addition to the weight of the hydrogen) when the density of air is 1.29 kg/m3.
2. Additional lab assignments are given that require analysis of a given physical system, including but not limited to the examples below, and then design a laboratory experiment to measure and confirm the analysis.
    1. a spinning and falling yo-yo
    2. a swinging pendulum
    3. or a falling object

Textbooks:

- John D. Cutnell; Kenneth W. Johnson; David Young; Shane Stadler (2018). *Physics* Wiley. ISBN: 978-1-119-39187
- Urone. P, Hinrichs, R. (2019). *College Physics* Openstax. ISBN: ISBN-10: 1-947172-01

Other Resources:

- Planck, Hanna, Burns. Advanced Physics Labs 1 Lab Manual. PASCO Scientific , 01-01-2019.
- Appel, K., Gastineau, J.,Vernier, D. Physics with Vernier 4th Edition. Vernier , 09-01-2019.

Minimum Qualification

- Physics/Astronomy (Masters Required)