Lecture Contact Hours: 48-54; Outside-of-Class Hours: 96-108; Laboratory Contact Hours: 48-54; Outside-of-Class Hours: 0; Total Student Learning Hours: 192-216

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Physics 130 – Fundamentals of Physics

3 hours lecture, 3 units
3 hours laboratory, 1 unit
Total Units: 4

Catalog Description
A mathematical and philosophical introduction to basic physical phenomena including force, linear and rotational motion, momentum, work and energy, simple harmonic motion and wave behavior, heat and thermodynamics using calculum, trigonometry and algebra-based problem solving. Laboratory experience is an integral part of this course.

Prerequisite
"C" grade or higher or "Pass" or concurrent enrollment in MATH C2210 (formerly MATH 180) or equivalent

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Solve algebraic word problems by using substitution or simultaneous equations.
2) Application of trigonometric functions and their identities.
3) Solve linear, quadratic and trigonometric equations.
4) Application of related rates and derivatives.
5) Integrate polynomial, exponential and trigonometric functions.

Course Content
1) Lecture
   a. Vectors and scalars
   b. Kinematics
   c. Dynamics (Newton's laws)
   d. Momentum
   e. Work and Energy
   f. Rotational Kinematics and Dynamics
   g. Statics
   h. Gravitation
   i. Simple harmonic motion
   j. Wave motion
   k. Standing waves
   l. Fluids
   m. Temperature and thermal expansion
   n. Heat and heat transfer
   o. Ideal gases
   p. Laws of Thermodynamics
   q. Kinetic theory of gases
   r. Heat engines
   s. Entropy
   t. Historical development of physics
   u. Application of physics principles to the real world

2) Labs
   a. Describing One-Dimensional Motion
   b. Freefall
   c. Projectile Motion
   d. Friction
   e. Uniform Circular Motion
   f. Ballistic Pendulum (Energy and Momentum)
   g. Impulse and Momentum
   h. Torque and Inertia
   i. Simple Harmonic Motion
   j. Ideal Gal Law and Absolute Zero
   k. Specific Heat of a Metal

Course Objectives

Students will be able to:

1) Recognize the basic concepts concerning kinematics, dynamics, energy, momentum, gravitation, oscillations, wave behavior and thermodynamics, and use mathematical expressions including calculus to represent physical situations involving these subjects.
2) Investigate and delineate the relationship between the theoretical principles of physics and their practical applications, and explain how this relationship affects real world problem solving.
3) Investigate, interpret and analyze the fundamental principles of physics based on reading assignments and in-class discussions.
4) Calculate solutions to physics problems using the fundamental principles of physics and symbolic logic skills.

During the lab students will:

5) Design experiments using the scientific method.
6) Demonstrate laboratory technique by collecting data using both traditional and computer data acquisition methods, using computers to interpret and analyze numerical data and to generate a visual representation of the data.
7) Evaluate the experimental results using techniques presented in class.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in the subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

1) Quizzes, exams that measure the student's ability to recognize physical situations and the concepts associated with them, and use mathematical expressions to formulate solutions while under a time pressure.
2) Homework that measures the student's ability to use the fundamental principles of physics and symbolic logic skills to calculate solutions to physics problems.
3) Lab technique that demonstrates the student's ability to design an experiment, set up the equipment, make the appropriate measurements, and maintain a safe work environment.
4) Lab reports that demonstrate the student's ability to use the English language; record, interpret and analyze data; draw conclusions from the results.
5) Physics research paper(s) in which students are required to analyze, interpret and draw conclusions from scientific sources.
6) Participation based on in-class responses to questions, contribution to discussions, and attendance.

Special Materials Required of Student

Scientific calculator

Minimum Instructional Facilities

1) Laboratory with Smartcart, blackboard, appropriate lab/demonstration equipment

2) Computers with data acquisition probes

Method of Instruction
1) Integrated lecture, demonstration, discussion
2) Small/large group discussion
3) In-class activities and independent homework, research projects
4) Group work in a laboratory situation
5) Instructional slides, video presentations
6) Auxiliary use of study groups, peer tutoring and/or instructional office hours

Out-of-Class Assignments
1) Required reading in the textbook or other recommended sources
2) Completion of pre-class and post-class exercises in both lecture and lab
3) Completion of research or other assignments and written laboratory work

Texts and References
1) Required (representative example): Cutnell, John D. and Kenneth W. Johnson. *College Physics*. 11th edition. John Wiley and Sons, 2018.
2) Supplemental: None

Exit Skills
Students having successfully completed this course exit with the following skills, competencies and/or knowledge:
1) Solve linear and rotational kinematics problems.
2) Use the relationship between force, mass and acceleration to solve dynamics problems.
3) Use conservation of energy and conservation of momentum concepts.
4) Understand simple harmonic motion and apply its concepts to analyze oscillating systems.
5) Understand the concepts of heat, thermodynamics and ideal gases and be able to use them in solving problems involving thermal equilibrium, heat transfer and heat engines.

Student Learning Outcomes
Upon successful completion of this course, students will be able to:
1) Evaluate biological systems and medical technologies in order to articulate how physical concepts like motion, force, energy, and fluid dynamics govern their function and operation.
2) Apply the principle of conservation of energy to systems acted upon by conservative gravitational forces in order to obtain information about velocity or position.
3) Use Newton's Second Law to analyze the forces acting on a system in order to obtain information about its motion (position, speed, acceleration).
4) Graph quantitative data gathered from biological systems in order to draw scientific conclusions and predict mathematical relationships between variables.