Course Description for **P-Physics (SCI303/304)**

DEPARTMENT: Science

GRADE: 11 and 12

LENGTH: One year

CREDITS: 10 (Ten)

PREREQUISITE: Biology and Algebra I or Interactive Mathematics Project I

COURSE DESCRIPTION: A study of the means by which man observes, measures, and attempts to explain his material universe. Motion, forces, waves, machines, light, magnetism, and electricity are studied. About 60 percent of class time is devoted to laboratory work. This course meets college entrance requirements, and is aligned to the physics content standards. This course is aligned to the California Science Content Standards.

EXIT CRITERIA: **Investigation and Experimentation**

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other four strands, students should develop their own questions and perform investigations. Students will:

- Select and use appropriate tools and technology (such as computer-linked probes, spread sheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- Identify and communicate sources of unavoidable experimental error.
- Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- Formulate explanations using logic and evidence.
- Solve scientific problems using quadratic equations, and simple trigonometric, exponential, and logarithmic functions.
- Distinguish between hypothesis and theory as science terms.
- Recognize the use and limitations of models and theories as scientific representations of reality.

- Recognize the issues of statistical variability and the need for controlled tests.

- Recognize the cumulative nature of scientific evidence.

- Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

- Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.

- Know that when an observation does not agree with an accepted scientific theory, sometimes the observation is mistaken or fraudulent (e.g., Piltdown Man fossil or unidentified flying objects), and sometimes the theory is wrong (e.g., Ptolemaic model of the movement of the sun, moon and planets).

Motion and Forces

Newton's laws predict the motion of most objects. As a basis for understanding this concept, students know:

- How to solve problems involving constant speed and average speed.

- When forces are balanced no acceleration occurs, and thus an object continues to move at a constant speed or stays at rest (Newton's First Law).

- How to apply the law F=ma to solve one-dimensional motion problems involving constant forces (Newton's Second Law).

- When one object exerts a force on a second object, the second object always exerts a force of equal magnitude and opposite direction. (Newton's Third Law).

- The relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.

- Applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (for example,

the Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).

- Circular motion requires application of a constant force directed toward the center of the circle.

Conservation of Energy and Momentum

The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept, students know:

- How to calculate kinetic energy using the formula E=(1/2)mv2.
- How to calculate changes in gravitational potential energy near the Earth using the formula (change in potential energy) =mgh (change in the elevation).
- How to solve problems involving conservation of energy in simple systems such as falling objects.
- How to calculate momentum as product mv.
- Momentum is a separately conserved quantity, different from energy.
- An unbalanced force on an object produces a change in its momentum.
- How to solve problems involving elastic and inelastic collisions in one dimension using the principles of conservation of momentum and energy.

Heat and Thermodynamics

Energy cannot be created or destroyed although in many processes energy is transferred to the environment as heat. As a basis for understanding this concept, students know:

- Heat flow and work are two forms of energy transfer between systems.
- The work done by a heat engine that is working in a cycle is the difference between the heat flow into the engine at high temperature and the heat flow out at a lower temperature (First Law of Thermodynamics) and that this is an example of the law of conservation of energy.

- Thermal energy (commonly called heat) consists of random motion and the vibrations and rotations of atoms and molecules. The higher the temperature, the greater the atomic or molecular motion.

- Most processes tend to decrease the order of a system over time, and energy levels are eventually distributed uniformly.

- Entropy is a quantity that measures the order or disorder of a system, and is larger for a more disordered system.

Waves

Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept, students know:

- Waves carry energy from one place to another.

- How to identify transverse and longitudinal waves in mechanical media such as springs, ropes, and the Earth (seismic waves).

- How to solve problems involving wavelength, frequency, and wave speed.

- Sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.

- Radio waves, light and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in vacuum is approximately 3x108 m/s (186,000 miles/second).

- How to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.

Electronic and Magnetic Phenomena

Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept, students know:

- How to predict the voltage or current in simple direct current electric circuits constructed from batteries, wires, resistors, and capacitors.

- How to solve problems involving Ohm's law.

- Any resistive element in a DC circuit dissipates energy which heats the resistor. Students can calculate the power (rate of energy dissipation) in

any resistive circuit element by using the formula Power = (potential difference IR) times (current I) = I2R.

- The properties of transistors and their role in electric circuits.
- Charged particles are sources of electric fields and experience forces due to the electric fields from other charges.
- Magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and experience forces due to magnetic fields of other sources.
- How to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.
- Changing magnetic fields produce electric fields, thereby inducing currents in nearby conductors.
- Plasmas, the fourth state of matter, contain ions and/or free electrons and conduct electricity.

GRADING CRITERIA:

Activities	**Percentages**
Homework	10%
Assessment	30%
Final Test	10%
Lab	50%

TEXTBOOK: **Conceptual Physics, 3rd Edition**

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