Course Outline

COURSE: PHYS 4A  DIVISION: 10  ALSO LISTED AS:

TERM EFFECTIVE: Spring 2018  CURRICULUM APPROVAL DATE: 10/09/2017

SHORT TITLE: PHYS FOR SCI & ENG I

LONG TITLE: Physics for Scientists and Engineers - Mechanics

<table>
<thead>
<tr>
<th>Units</th>
<th>Number of Weeks</th>
<th>Contact Hours/Week</th>
<th>Total Contact Hours</th>
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<tr>
<td>4</td>
<td>18</td>
<td>Lecture: 3</td>
<td>Lecture: 54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lab: 3</td>
<td>Lab: 54</td>
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<td></td>
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<td>Other: 0</td>
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COURSE DESCRIPTION:

An introduction to the principles of physics using calculus. Topics include kinematics in one, two and three dimensions, vectors, equilibrium and non-equilibrium applications of Newton's Laws, work and energy, momentum, systems of particles, rotational kinematics and dynamics, simple harmonic motion, elasticity, and waves. (C-ID: PHYS 205) (C-ID: PHYS 200S: Phys 4A + Phys 4B + Phys 4C) PREREQUISITE: Completion of MATH 1A with a grade of 'C' or better, AND completion of PHYS 2A with a grade of 'C' or better OR High School Physics with a grade of 'B' or better. COREQUISITE: MATH 1B (Effective Fall 2018)

PREREQUISITES:

(Completion of PHYS 2A, as UG, with a grade of C or better.
AND Completion of MATH 1A, as UG, with a grade of C or better.
AND Completion of MATH 1B, as UG, with a grade of C or better., Concurrent OK)
OR
(Completion of PHYS 2A, as UG, with a grade of C or better.
AND Completion of MATH 1C, as UG, with a grade of C or better.)

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES
L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated
SCHEDULE TYPES:
   02 - Lecture and/or discussion
   03 - Lecture/Laboratory
   04 - Laboratory/Studio/Activity

STUDENT LEARNING OUTCOMES:
1. Identify, describe, compare and contrast the various units of numbers and their significance.
   Measure of assessment: Exam, Lab
2. Describe vectors and their manipulation and use them as problem solving tools.
   Measure of assessment: Exam, Lab
   Year assessed, or planned year of assessment: 2018
   Semester: Spring
3. Identify, describe, compare and contrast distance, displacement, speed, velocity and acceleration.
   Measure of assessment: Exam, Lab
   Year assessed, or planned year of assessment: 2018
   Semester: Spring
4. Identify, describe, compare and contrast various forces, Newton's Laws, conservation of momentum,
   conservation of energy, power and work.
   Measure of assessment: Exam, Lab
   Year assessed, or planned year of assessment: 2018
   Semester: Spring
5. Identify, describe, compare and contrast rotational kinematics and dynamics.
   Measure of assessment: Exam, Lab
6. Identify and describe simple harmonic motion.
   Measure of assessment: Exam, Lab
7. Identify, describe, compare and contrast longitudinal, transverse and sound waves.
   Measure of assessment: Exam, Lab
8. Identify and describe the role of calculus as a tool to describe the physical world.
   Measure of assessment: Exam, Lab

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS
Curriculum Approval Date: 10/09/2017
HOURS
3 Lect/3 Lab
CONTENT
Introduction, numbers and units, math review.
OUT-OF-CLASS ASSIGNMENTS
Reading and homework problems from text.
STUDENT PERFORMANCE OBJECTIVES
Identify and discuss the significance of units of various quantities, convert between systems of units, solve
equations with one or two variables, solve right triangles.
LAB: Math review.
HOURS
3 Lect/3 Lab
CONTENT
One-dimensional kinematics.
OUT-OF-CLASS ASSIGNMENTS
Reading and homework from text.
STUDENT PERFORMANCE OBJECTIVES
Identify, compare and contrast distance, displacement, speed, velocity and acceleration. Identify, set-up and solve one dimensional kinematics problems.
LAB: Free-fall determination of g.
HOURS
3 Lect/3 lab
CONTENT
Vector analysis.
OUT-OF-CLASS ASSIGNMENTS
Problems and reading from the text.

STUDENT PERFORMANCE OBJECTIVES
Identify, describe and find the components of a vector and the sum, difference, and product of two or more vectors in one-, two-, and three dimensions.
LAB: Finding resultant vectors.
HOURS
3 Lect/3 Lab
CONTENT
Two- and three-dimensional kinematics.
OUT-OF-CLASS ASSIGNMENTS
Problems and reading from text.

STUDENT PERFORMANCE OBJECTIVES
Identify, set-up, and solve two- and three-dimensional kinematics problems.
LAB: Projectile motion.
HOURS
6 Lect/6 Lab
CONTENT
Forces. Newton's Laws.
OUT-OF-CLASS ASSIGNMENTS
Reading and problems for text.

STUDENT PERFORMANCE OBJECTIVES
Discuss, compare and contrast Newton's Laws and apply Newton's Second Law to accelerating and non-accelerating systems. Construct an accurate free-body diagram. Identify, set-up and solve problems involving Newton's Laws.
LAB: Acceleration of a system subjected to unbalanced forces.
HOURS
3 Lect/3 Lab
CONTENT
Uniform circular motion.
OUT-OF-CLASS ASSIGNMENTS
Reading and problems from text.

STUDENT PERFORMANCE OBJECTIVES
Identify and include centripetal forces in the set-up and solution of problems involving Newton's Laws.
LAB: Centripetal acceleration.
HOURS
3 Lect/3 Lab
CONTENT
Work and Energy.
OUT-OF-CLASS ASSIGNMENTS
Problems and reading from text.
STUDENT PERFORMANCE OBJECTIVES
Discuss and describe the principle of conservation of energy, compare and contrast potential and kinetic energy, discuss work done by conservative and non-conservative forces. Identify, set-up and solve energy problems using the work-energy theorem.
LAB: Conservation of energy.
HOURS
3 Lect/3 Lab
CONTENT
Momentum.
OUT-OF-CLASS ASSIGNMENTS
Reading and problems from text.
STUDENT PERFORMANCE OBJECTIVES
Discuss the impulse-momentum theorem, the principle of conservation of momentum, and compare and contrast elastic and inelastic collisions. Identify, set-up, and solve problems using the impulse-momentum theorem.
LAB: Conservation of momentum.
HOURS
3 Lect/3 Lab
CONTENT
Rotational kinematics.
OUT-OF-CLASS ASSIGNMENTS
Problems and reading from the text.
STUDENT PERFORMANCE OBJECTIVES
Discuss, compare and contrast rotational kinematics with one-dimensional kinematics. Identify, set-up, and solve rotational kinematics problems.
LAB: Angular acceleration of rotating objects.
HOURS
3 Lect/3 Lab
CONTENT
Rotational dynamics.
OUT-OF-CLASS ASSIGNMENTS
Reading and problems from text.
STUDENT PERFORMANCE OUTCOMES
Discuss, compare and contrast torque and force, application of Newton's Laws to rotating systems, and conservation of energy and momentum for rotating systems. Identify, set-up, and solve problems using Newton's Laws and conservation of energy and momentum for rotating systems.
LAB: Equilibrium of a rigid bar subjected to torques.
HOURS
3 Lect/3 Lab
CONTENT
Spring forces and elasticity.
OUT-OF-CLASS ASSIGNMENTS
Problems and reading from text.
STUDENT PERFORMANCE OBJECTIVES
Students will identify and include forces due to springs in the set-up and solution of problems using Newton's Laws. Students will discuss, compare and contrast stress, strain, and the elastic moduli of materials. Students will identify, set-up and solve simple harmonic motion and elasticity problems.
LAB: Stress-strain behavior of solids.

HOURS
3 Lect/3 Lab

CONTENT
Fluids.

OUT-OF-CLASS ASSIGNMENTS
Reading and problems from text.

STUDENT PERFORMANCE OBJECTIVES
Identify, discuss, compare and contrast solids, liquids and vapors, the properties of liquids and gases in terms of density, velocity and pressure. Identify, set-up and solve problems using Bernoulli's equation and Archimedes principle. Compare and contrast Archimedes principle and Newton's Second Law. Identify, set-up and solve fluids problems.

LAB: Stress-strain behavior of solids.

HOURS
3 Lect/3 Lab

CONTENT
Systems of particles.

OUT-OF-CLASS ASSIGNMENTS
Problems and reading from text.

STUDENT PERFORMANCE OBJECTIVES
Identify, describe, compare and contrast the configuration, Newton's Second Law, and conservation of momentum, for multi-particle and single particle systems.

LAB: Conservation of momentum for multi-particle systems.

HOURS
3 Lect

CONTENT
Gravitation

OUT-OF-CLASS ASSIGNMENTS
Reading and problems from the text.

STUDENT PERFORMANCE OBJECTIVES
Identify, describe, compare and contrast Newton's Second Law and Newton's Universal Law of Gravitation. Describe Earth's gravitational field. Identify, set-up, and solve Gravitation problems.

HOURS
3 Lect/3 Lab

CONTENT
Oscillations

OUT-OF-CLASS ASSIGNMENTS
Problems and reading from the text.

STUDENT PERFORMANCE OBJECTIVES
Identify, describe, compare and contrast simple harmonic motion, uniform circular motion, and pendulum motion. Identify and describe conservation of energy in oscillating systems. Identify, set-up, and solve oscillation problems.

LAB: Pendulum motion.

HOURS
4 Lect

CONTENT
Waves.
OUT-OF-CLASS ASSIGNMENTS
Reading and problems from text.

STUDENT PERFORMANCE OBJECTIVES
Identify, discuss, compare and contrast transverse and longitudinal waves, sound waves, interference and superposition of waves, diffraction, and standing waves. Identify, set-up, and solve wave problems.

HOURS
2

Final Exam
3 Lect/3 Lab

CONTENT
Systems of particles.

OUT-OF-CLASS ASSIGNMENTS
Problems and reading from text.

STUDENT PERFORMANCE OBJECTIVES
Identify, describe, compare and contrast the configuration, Newton's Second Law, and conservation of momentum, for multi-particle and single particle systems. Identify, set-up, and solve multi-particle system problems.

LAB: Conservation of momentum for multi-particle systems.

HOURS
3 Lect

CONTENT
Gravitation

OUT-OF-CLASS ASSIGNMENTS
Reading and problems from the text.

STUDENT PERFORMANCE OBJECTIVES
Identify, describe, compare and contrast Newton's Second Law and Newton's Universal Law of Gravitation. Describe Earth’s gravitational field. Identify, set-up, and solve Gravitation problems.

HOURS
3 Lect/3 Lab

CONTENT
Oscillations

OUT-OF-CLASS ASSIGNMENTS
Problems and reading from the text.

STUDENT PERFORMANCE OBJECTIVES
Identify, describe, compare and contrast simple harmonic motion, uniform circular motion, and pendulum motion. Identify and describe conservation of energy in oscillating systems. Identify, set-up, and solve oscillation problems.

LAB: Pendulum motion.

HOURS
4 Lect

CONTENT
Waves.

OUT-OF-CLASS ASSIGNMENTS
Reading and problems from text.

STUDENT PERFORMANCE OBJECTIVES
Identify, discuss, compare and contrast transverse and longitudinal waves, sound waves, interference and superposition of waves, diffraction, and standing waves. Identify, set-up, and solve wave problems.

HOURS
2
Final Exam
Lab Content:
Lab activities are listed above.

**METHODS OF INSTRUCTION:**
Lecture/discussion. Laboratory exercises. Group projects.

**OUT OF CLASS ASSIGNMENTS:**
Required Outside Hours: 64
Assignment Description: Regularly assigned homework that requires students to analyze and study pertinent text material, solved examples and lecture notes.
Required Outside Hours: 64
Assignment Description: Regularly assigned homework that requires students to apply the principles and skills covered in class by solving related problems.

**METHODS OF EVALUATION:**
Objective examinations
Percent of total grade: 60.00 %
In-class written exams.
Writing assignments
Percent of total grade: 20.00 %
Lab reports.
Problem-solving assignments
Percent of total grade: 20.00 %

**REPRESENTATIVE TEXTBOOKS:**
Required Representative Textbooks
Reading Level of Text, Grade: 12 Verified by: Jennifer Nari

**ARTICULATION and CERTIFICATE INFORMATION**
Associate Degree:
- GAV B1, effective 201270
- GAV B3, effective 201270
CSU GE:
- CSU B1, effective 201270
- CSU B3, effective 201270
IGETC:
- IGETC 5A, effective 201270
- IGETC 5C, effective 201270
CSU TRANSFER:
- Transferable CSU, effective 201270
UC TRANSFER:
- Transferable UC, effective 201270

**SUPPLEMENTAL DATA:**
Basic Skills: N

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