**PHYS 20A Course Outline as of Fall 2020**

# CATALOG INFORMATION

Dept and Nbr: PHYS 20A Title: GENERAL PHYSICS PART I
Full Title: General Physics Part I
Last Reviewed: 4/8/2019

| Units | | Course Hours per Week | | Nbr of Weeks | Course Hours Total | |
|---|---|---|---|---|---|---|
| Maximum | 4.00 | Lecture Scheduled | 3.00 | 17.5 | Lecture Scheduled | 52.50 |
| Minimum | 4.00 | Lab Scheduled | 3.00 | 8 | Lab Scheduled | 52.50 |
| | | Contact DHR | 0 | | Contact DHR | 0 |
| | | Contact Total | 6.00 | | Contact Total | 105.00 |
| | | Non-contact DHR | 0 | | Non-contact DHR | 0 |

Total Out of Class Hours: 105.00 Total Student Learning Hours: 210.00

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|---|---|
| Title 5 Category: | AA Degree Applicable |
| Grading: | Grade or P/NP |
| Repeatability: | 00 - Two Repeats if Grade was D, F, NC, or NP |
| Also Listed As: | |
| Formerly: | |

**Catalog Description:**
This course uses vectors and algebra to investigate translational and rotational motion, Newton's laws, conservation of momentum and energy, oscillations, mechanical waves (including sound), fluid mechanics, and thermodynamics.

**Prerequisites/Corequisites:**
Completion of MATH 27 or higher (MATH) OR Course Completion of MATH 25 and MATH 58 <a href='https://assessment.santarosa.edu/what-appropriate-placement-based-ab-705-mandates' class='NormalSiteLink' target='_New'>or appropriate placement based on AB 705 mandates</a>

**Recommended Preparation:**
One year of high school physics; OR Course Completion of PHYS 1

**Limits on Enrollment:**

**Schedule of Classes Information:**
Description: This course uses vectors and algebra to investigate translational and rotational motion, Newton's laws, conservation of momentum and energy, oscillations, mechanical waves (including sound), fluid mechanics, and thermodynamics. (Grade or P/NP)

Prerequisites/Corequisites: Completion of MATH 27 or higher (MATH) OR Course Completion of MATH 25 and MATH 58 <a href='https://assessment.santarosa.edu/what-appropriate-placement-based-ab-705-mandates' class='NormalSiteLink' target='_New'>or appropriate placement based on AB 705 mandates</a>
Recommended: One year of high school physics; OR Course Completion of PHYS 1
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

## ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

| | | | | |
|---|---|---|---|---|
| **AS Degree:** | **Area** | | Effective: | Inactive: |
| | C | Natural Sciences | Fall 2020 | |
| **CSU GE:** | **Transfer Area** | | Effective: | Inactive: |
| | B1 | Physical Science | Fall 2020 | |
| | B3 | Laboratory Activity | | |
| **IGETC:** | **Transfer Area** | | Effective: | Inactive: |
| | 5A | Physical Sciences | Fall 2020 | |
| | 5C | Fulfills Lab Requirement | | |

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| **CSU Transfer:** | Transferable | Effective: | Fall 2020 | Inactive: |
| **UC Transfer:** | Transferable | Effective: | Fall 2020 | Inactive: |

**CID:**

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| CID Descriptor:PHYS 100S | Algebra/Trigonometry-Based Physics: AB |
| SRJC Equivalent Course(s): | PHYS20 AND PHYS20L AND PHYS21 AND PHYS21L OR PHYS20A AND PHYS20B |
| CID Descriptor:PHYS 105 | Algebra/Trigonometry-Based Physics A |
| SRJC Equivalent Course(s): | PHYS20 AND PHYS20L OR PHYS20A |

**Certificate/Major Applicable:**
Major Applicable Course

## COURSE CONTENT

**Student Learning Outcomes:**
At the conclusion of this course, the student should be able to:
1. Apply physics principles and laws to analyze and solve physics problems in mechanics, fluids,
   waves, and thermodynamics through critical thinking, problem solving, mathematical modeling, and laboratory experimentation.
2. Measure and analyze real-world experimental data related to principles of physics, including appropriate use of units and significant figures.

**Objectives:**
At the conclusion of this course, the student should be able to:
1. Convert to and from various units.
2. Perform algebraic operations with scalars and vectors.
3. Predict the future trajectory of an object in two dimensions with uniform acceleration.
4. Use Newton's laws of motion to analyze a physical situation with multiple constant forces acting on a point mass.

5. Identify various forms of energy and analyze a physical situation using concepts of work and energy.
6. Define momentum and use the conservation of momentum principle to solve problems related to elastic and inelastic collisions.
7. Describe and analyze static and dynamic extended systems using the concepts of torque and angular acceleration.
8. Define physical properties of solids and fluids, pressure, and buoyant force.
9. Explain laws of thermodynamics and the physics of heat, temperature, and thermal energy.
10. Describe concepts of waves, vibration and oscillation, and discuss their applications in the analysis of pendulum, sound, and interference.

Lab objectives:
1. Conduct experiments that apply the scientific method and error analysis to explore physics principles.
2. Use manual and computerized data collection techniques to measure and analyze parameters related to physics.
3. Plot, curve fit, and interpret data using a spreadsheet or other analysis tool.

**Topics and Scope:**

I. Units and Measurements
II. Vectors and Scalars
  A. Vector components
  B. Vector addition
III. Translational Kinematics in One and Two Dimensions
  A. Displacement, velocity, and acceleration
  B. Instantaneous and average values of quantities
  C. Relationships between motion graphs
  D. Free-fall, projectile, and circular motion
IV. Newton's Laws of Motion
  A. Newton's three laws
  B. Types of forces including tension, friction, gravitational, and normal
V. Work and Energy
  A. Definitions of work, kinetic energy and potential energy
  B. Work-Energy Theorem
  C. Conservative and non-conservative forces
  D. Conservation of energy
  E. Power
VI. Momentum
  A. Conservation of linear momentum
  B. Elastic and inelastic collisions
  C. Impulse-Momentum Theorem
VII. Rotational Motion
  A. Angular position, velocity and acceleration
  B. Torque, Newton's Second Law for torques, and static equilibrium
  C. Moments of inertia
  D. Angular momentum
VIII. Solids and Fluids
  A. Pressure-depth relationship and Pascal's Law
  B. Buoyancy and Archimedes' Principle
  C. Fluid dynamics and Bernoulli's Equation

IX. Simple Harmonic Motion
   A. Equations of motion for oscillations
   B. Pendulum and spring systems
X. Mechanical Waves and Sound
   A. Speed, frequency, and wavelength
   B. Traveling and standing waves
   C. Doppler effect
XI. Laws of Thermodynamics and Heat Engines
   A. Temperature and heat
   B. Heat transfer
   C. Ideal gas law and kinetic theory
   D. First and second laws of thermodynamics
   E. Entropy
   F. Heat engine cycles

Lab Topics:
I. Laboratory Safety and Procedures
II. Writing Lab Reports
III. Measurement Techniques for Mechanical Systems
   A. Manual data collection with calipers, stop watches, meter sticks, etc.
   B. Computerized data collection with motion detectors, force probes, etc.
IV. Data Processing and Graphing Results with Spreadsheets
V. Error Analysis

**Assignment:**

Lecture-Related Assignments:
1. Homework problem sets (12 - 20)
2. Quizzes (0 - 15)
3. Midterm exams (3 - 5)
4. Final exam

Lecture- and Lab-Related Assignments:
1. Individual and/or group lab experiments and reports (12-16)

**Methods of Evaluation/Basis of Grade:**

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

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| Lab reports (individual and/or group) | Writing<br>10 - 25% |

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

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| Homework problem sets | Problem solving<br>10 - 30% |

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

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| None | Skill Demonstrations<br>0 - 0% |

**Exams:** All forms of formal testing, other than skill performance exams.

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| Quizzes, midterm exams, and final exam | Exams<br>50 - 75% |

**Other:** Includes any assessment tools that do not logically fit into the above categories.

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| Lecture and laboratory participation | Other Category<br>0 - 10% |

**Representative Textbooks and Materials:**
Physics. 11th ed. Cutnell, John and Johnson, Kenneth and Young, David and Stadler, Shane. Wiley. 2018
College Physics: A Strategic Approach. 4th ed. Knight, Randall and Jones, Brian and Field, Stuart. Pearson. 2018
Essentials of College Physics. Serway, Raymond and Vuille, Chris. Cengage Learning. 2007 (Classic)
Instructor-prepared lab manual