

# PHYS 2AM: GENERAL PHYSICS: CALCULUS SUPPLEMENT

## Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	1
Hours:	1 lecture per week (12 total per quarter)
Prerequisite:	MATH 1A or 1AH.
Corequisite:	Completion of or concurrent enrollment in MATH 1B or 1BH, and PHYS 2A.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	CSU/UC
Grade Type:	Letter Grade Only
Repeatability:	Not Repeatable

## Student Learning Outcomes

- The student will be able to apply derivatives to problems in kinematics, dynamics, energy, momentum and related topics
- The student will be able to apply integrals to problems in kinematics, dynamics, energy, momentum and related topics.

## Description

Application of calculus to physics topics and problems in mechanics.

## Course Objectives

The student will be able to:

- Apply calculus to problems in kinematics
- Solve  $F=ma$  problems with non-constant forces
- Apply calculus to work-energy problems
- Apply calculus to momentum/impulse problems
- Calculate quantities involved in rotational motion
- Solve problems involving Newtonian gravity
- Interpret simple harmonic oscillators in terms of differential equations

## Course Content

- Apply calculus to problems in kinematics
  - Review of derivatives
    - Concept of a limit
    - Concept of a derivative
    - Derivatives of polynomials
    - Derivatives of other functions
    - Product rule and chain rule
  - Velocity and acceleration with derivatives
    - Definitions of average velocity and acceleration
    - Velocity and acceleration as derivatives
    - Graphical interpretations

- Review of integration
  - Indefinite integrals
  - Definite integrals
- Kinematics with integration
  - Position and velocity from acceleration
  - Formulae for constant acceleration
  - Graphical interpretations
- Solve  $F=ma$  problems with non-constant forces
  - $F=ma$  with forces that are a function of position
    - The general approach
    - Hooke's Law
    - $1/r^2$  forces
  - Velocity-dependent forces
    - Drag proportional to velocity
    - Drag proportional to the square of velocity
- Apply calculus to work-energy problems
  - Potential energy of non-constant forces
  - Power
  - Energy diagrams
- Apply calculus to momentum/impulse problems
  - Impulse
  - Momentum with changing mass
- Calculate quantities involved in rotational motion
  - Relationship to linear mechanics
  - Center of mass
  - Moment of inertia calculations
- Solve problems involving Newtonian gravity
  - Work
  - Potential energy
- Interpret simple harmonic oscillators in terms of differential equations
  - What is a differential equation?
  - Solutions to a second-order differential equation
  - The role of initial conditions
  - Energy in simple harmonic oscillators

## Lab Content

Not applicable.

## Special Facilities and/or Equipment

When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address.

## Method(s) of Evaluation

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

Weekly assignments  
Midterms  
Final examination

## **Method(s) of Instruction**

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

Lecture  
Demonstration

## **Representative Text(s) and Other Materials**

Instructor-generated materials. Text at the level of Halliday and Resnick optional.

## **Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments**

1. Homework problems covering subject matter from text and related material ranging from 5-15 problems per week. Students will need to employ critical thinking in order to complete assignments.
2. One hour per week of lecture covering subject matter from text and related material. Reading and study of the textbook, related materials and notes.

## **Discipline(s)**

Physics/Astronomy