PHY101 : Physics for Scientists and Engineers: A

General Information

Author:	• Jason Marshall
Course Code (CB01) :	PHY101
Course Title (CB02) :	Physics for Scientists and Engineers: A
Department:	PHY
Proposal Start:	Spring 2025
TOP Code (CB03) :	(1902.00) Physics, General
CIP Code:	(40.0801) Physics, General.
SAM Code (CB09) :	Non-Occupational
Distance Education Approved:	No
Will this course be taught asynchronously?:	No
Course Control Number (CB00) :	CCC000117803
Curriculum Committee Approval Date:	06/12/2024
Board of Trustees Approval Date:	Pending
Last Cyclical Review Date:	02/01/2020
Course Description and Course Note:	PHY 101 is the first course in a three-semester sequence intended for students majoring in engineering and the physical sciences. The course covers topics in classical mechanics, including motion, kinematics, forces, work, energy, momentum, angular motion, static equilibrium, and Newtonian gravity. Vectors and derivatives are used extensively throughout the course. Computers and numerical techniques are used extensively in the laboratory component of the course. Modified a two SLOs and deleted two. Punctuation changes in multiple sections.
Justification:	Content Change
Academic Career:	• Credit
Author:	• Jason Marshall

Academic Senate Discipline

Primary Discipline:	• Physics/Astronomy
Alternate Discipline:	No value
Alternate Discipline:	No value

Course Development

Basic Skill Status (CB08)

Course is not a basic skills course.

Course Special Class Status (CB13)

Course is not a special class.

Grading Basis

- Grade Only

Allow Students to Gain Credit by Exam/Challenge

Pre-Collegiate Level (CB21)

Not applicable.

Course Support Course Status (CB26)

Course is not a support course

Transferability & Gen. Ed. Options

General Education Status (CB25)

Not Applicable

Transferability

Transferable to both UC and CSU

Transferability Status

Approved

IGETC Area	Area	Status	Approval Date	Comparable Course
5A-Physical Science	Physical Science	Approved	09/09/1991	No Comparable Course defined.
5C-Science Laboratory	Science Laboratory	Approved	09/09/1991	

CSU GE-Breadth Area	Area	Status	Approval Date	Comparable Course
B1-Physical Science	Physical Science	Approved	No value	No Comparable Course defined.
B3-Laboratory Activity	Laboratory Activity	Approved	No value	

C-ID	Area	Status	Approval Date	Comparable Course
PHY	Physics	Approved	02/17/2015	PHYS 205 - Calculus-Based Physics for Scientists and Engineers: A

Units and Hours

Summary

Minimum Credit Units (CB07)	5
Maximum Credit Units (CB06)	5
Total Course In-Class (Contact) Hours	126
Total Course Out-of-Class Hours	144
Total Student Learning Hours	270

Credit / Non-Credit Options

Course Type (CB04)

Credit - Degree Applicable

Noncredit Course Category (CB22)

Credit Course.

Noncredit Special Characteristics

No Value

Course Classification Code (CB11)

Funding Agency Category (CB23)

Credit Course.

Not Applicable.

Cooperative Work Experience Education Status (CB10)

Variable Credit Course

Weekly Student Hours

	In Class	Out of Class
Lecture Hours	4	8
Laboratory Hours	3	0
Studio Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	54
Course In-Class (Contact) Hours	
Lecture	72
Laboratory	54
Studio	0
Total	126
Course Out-of-Class Hours	
Lecture	144
Laboratory	0
Studio	0
Total	144

Time Commitment Notes for Students

No value

Units and Hours - Weekly Specialty Hours

Activity Name	Type	In Class	Out of Class
No Value	No Value	No Value	No Value

Pre-requisites, Co-requisites, Anti-requisites and Advisories

Prerequisite

MATH103E - Calculus & Analytic Geometry I

Objectives

- find limits of functions at real values and at infinity using numerical, graphical, and algebraic approaches.
- Find the derivative of a function as a limit.
- Use the derivative for rate of change problems.
- Find the equation of a tangent line to a function at a point.
- Compute derivatives using differentiation formulas: constants, power rule, product rule, quotient rule and chain rule. Calculate higher order derivatives.
- Use differentiation to solve applications such as related rate problems and optimization problems.
- Find derivatives of transcendental functions: trigonometric, exponential, logarithmic, and others.
- Graph functions using the methods of calculus.
- Evaluate a definite integral as a limit of Riemann sums.
- Apply integration to find areas, apply properties of integrals.
- Use substitution to integrate.

AND

Prerequisite

MATH104E - Calculus and Analytic Geometry II

Objectives

- Determine work done in applications involving liquids and springs.
- Evaluate definite and indefinite integrals using a variety of techniques, including integration by parts, trigonometric substitution, and partial fractions.
- Evaluate improper integrals.
- Graph conic sections.

OR

Co-Requisite

MATH104E - Calculus and Analytic Geometry II

(may be taken concurrently)

AND

Advisory

High school physics

Entry Standards

Entry Standards

Course Limitations

Cross Listed or Equivalent Course

PHY 101H Honors Physics for Scientists and Engineers: A

Specifications

Methods of Instruction

Methods of Instruction	Lecture
Methods of Instruction	Laboratory
Methods of Instruction	Multimedia
Methods of Instruction	Demonstrations

Out of Class Assignments

- Problem sets (e.g. analytical word-problems assigned on a weekly basis)
- Written lab reports (e.g. describe and analyze the results of a collision experiment)

Methods of Evaluation	Rationale
Exam/Quiz/Test	Lecture examinations (including multiple-choice questions, short-response questions, and analytical word-problems)
Exam/Quiz/Test	Final examination (including multiple-choice questions, short-response questions, and analytical word-problems)
Exam/Quiz/Test	Laboratory practical examinations
Writing Assignment	Evaluation of problem sets
Report	Evaluation of written lab reports

Textbook Rationale

No Value

Textbooks

Author	Title	Publisher	Date	ISBN
Raymond A. Serway and John W. Jewett	Physics for Scientist and Engineers, Vol. 1	Brooks Cole	2013	978-1133947271
Ruth W. Chabay and Bruce A. Sherwood	Matter and Interactions, 4th Edition	Wiley	2020	978-1-119-08081-7

Other Instructional Materials (i.e. OER, handouts)

Description	Physics 101 Laboratory Manual
Author	R. Guglielmino
Citation	No value
Online Resource(s)	No value

Materials Fee

No value

Learning Outcomes and Objectives

Course Objectives

Analyze the motion of objects with constant acceleration.

Apply Newton’s laws of motion to the dynamics of physical systems.

Calculate the work performed by forces.

Explain conservation of energy, momentum, and angular momentum.

Use conservation laws to predict the state of dynamical systems.

Calculate forces necessary for the static equilibrium of physical objects.

Describe Newtonian gravity, and apply it to planetary motion.

Collect quantitative data from observations of physical phenomena.

Organize data in tables, and present data using graphs.

Use computers to perform calculations and to make graphs.

SLOs

Effectively and safely use scientific instruments and equipment. Expected Outcome Performance: 70.0

ILOs Core ILOs	Demonstrate depth of knowledge in a course, discipline, or vocation by applying practical knowledge, skills, abilities, theories, or methodologies to solve unique problems.
Physical Sciences Physical Science A.A. Degree	Explain the difference between evidence and theory in science and cite an example in their explanation.
	Use instruments and computers to accurately measure, graph, and analyze physical properties (these instruments will include calipers, micrometers, mass balances, spectrometers, interferometers, and digital oscilloscopes depending upon which courses the student had taken).
Physical Sciences Phsysics AS-T Degree	Perform various scientific experiments and to analyze data to check agreement with theoretical predictions
BIOL Biology AS-T	describe and demonstrate correct use of biology laboratory equipment;
	well-qualified as transfer students to a four-year university biology program.
ILOs General Education	examine causality or associations between or among variables of the natural world
PHY Physics	use instruments and computers to accurately measure, graph, and analyze physical properties

Employ differential and integral calculus to model physical phenomena. Expected Outcome Performance: 70.0

ILOs Core ILOs	Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate creativity that leads to innovative ideas.
	Use quantitative and/or analytical mathematical skills to solve problems and to interpret, evaluate, and process information and data to draw logical conclusions and support claims.

Physical Sciences Phsysics AS-T Degree	Apply appropriate physical laws and mathematical techniques to analyze various physical situations
	Perform various scientific experiments and to analyze data to check agreement with theoretical predictions
MATH Mathematics AS-T Degree	Evaluate limits, derivatives and integrals
	Solve applications in math and science using derivatives, integrals, differential equations and linear algebra
Physical Sciences Physical Science A.A. Degree	Explain the difference between evidence and theory in science and cite an example in their explanation.
	Use instruments and computers to accurately measure, graph, and analyze physical properties (these instruments will include calipers, micrometers, mass balances, spectrometers, interferometers, and digital oscilloscopes depending upon which courses the student had taken).
ILOs General Education	apply reasoning to evaluate hypotheses and theories
	examine causality or associations between or among variables of the natural world
MATH Mathematics - AS-T	evaluate limits, derivatives and integrals.
	solve a variety of rudimentary and second order differential equations.
	solve applications in math and science using derivatives, integrals, differential equations and linear algebra.
PHY Physics	explain the difference between evidence and theory in science and cite an example in their explanation
	use instruments and computers to accurately measure, graph, and analyze physical properties
BIOL Biology AS-T	well-qualified as transfer students to a four-year university biology program.

Apply theoretical knowledge to problems in experimental science and engineering. Expected Outcome Performance: 70.0

ILOs Core ILOs	Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate creativity that leads to innovative ideas.
Physical Sciences Phsysics AS-T Degree	Apply appropriate physical laws and mathematical techniques to analyze various physical situations
	Perform various scientific experiments and to analyze data to check agreement with theoretical predictions
Physical Sciences Physical Science A.A. Degree	Explain the difference between evidence and theory in science and cite an example in their explanation.
MATH Mathematics AS-T Degree	Solve applications in math and science using derivatives, integrals, differential equations and linear algebra
ILOs General Education	apply reasoning to evaluate hypotheses and theories
	examine causality or associations between or among variables of the natural world
BIOL Biology AS-T	describe and demonstrate correct use of biology laboratory equipment;
	well-qualified as transfer students to a four-year university biology program.
PHY Physics	explain the difference between evidence and theory in science and cite an example in their explanation
	use instruments and computers to accurately measure, graph, and analyze physical properties
MATH Mathematics - AS-T	solve applications in math and science using derivatives, integrals, differential equations and linear algebra.

Additional SLO Information

Does this proposal include revisions that might improve student attainment of course learning outcomes?

No Value

Is this proposal submitted in response to learning outcomes assessment data?

No Value

If yes was selected in either of the above questions for learning outcomes, explain and attach evidence of discussions about learning outcomes.

No Value

SLO Evidence

No Value

Course Content

Lecture Content

Units and Measurements (5 hours)
- SI system of units
- Conversion of units between the SI system and other systems

Motion in One Dimension (5 hours)
- Position
- Speed
- Acceleration
- Motion plots, i.e. plots of position or speed or acceleration versus time
- Kinematic equations for motion with constant acceleration
- Motion of objects in free fall

Vectors (5 hours)
- Introduction to vectors
- Scalar-vector multiplication
- Vector addition and subtraction
- Dot product and cross product

Motion in Two Dimensions (5 hours)
- Position
- Velocity
- Acceleration
- Kinematic equations for motion with constant acceleration in two dimensions
- Projectile motion

Force (5 hours)
- Friction
- Normal force
- Weight
- Tension
- Spring force
- Resistive forces

Newton's Laws of Motion (4 hours)

Circular Motion (5 hours)
- Rotating coordinate systems
- Radial and tangential components of velocity
- Radial and tangential components of acceleration
- Uniform vs. non-uniform circular motion

Work (4 hours)
- Work done by constant forces
- Work done by non-constant forces

Energy (5 hours)
- Definition of energy
- Kinetic energy
- Gravitational potential energy near Earth's surface
- Spring potential energy
- Conservative vs. non-conservative forces
- Potential energy and conservative forces

- The work-energy theorem
- Conservation of energy
- Energy plots
- Power

Linear Momentum (4 hours)
- The force-momentum theorem
- Conservation of momentum
- Head-on collisions
- Glancing collisions
- Elastic vs. inelastic collisions

Rotational Motion (5 hours)
- Angular position
- Angular velocity
- Angular acceleration
- Kinematic equations for motion with constant angular acceleration
- Moment of inertia

Torque (4 hours)
- Torque and force
- Torque and angular acceleration

Angular Momentum (4 hours)
- The torque-angular momentum theorem
- Conservation of angular momentum

System of Many Particles (4 hours)
- Center of mass
- Rigid bodies
- Decomposition of kinetic energy, linear momentum and angular momentum of a rigid body into translational and rotational components

Static Equilibrium (4 hours)

Universal Gravitation (4 hours)
- Newton's law of universal gravitation
- Gravitation near surface of Earth
- Gravitational potential energy
- Gravitational field
- Planetary motion

Total Hours: 72

Laboratory/Studio Content

Laboratory Content (54 Hours)
- Introduction to Excel
- Measuring the Mass of Earth
- Measuring Motion with Computer-Interfaced Ultrasonic Radar
- Projectile Motion – Excel Simulation
- Car Crash Analysis
- Falling Bodies and Air Resistance
- Introduction to Spherical Coordinates
- Measuring the Radius of Earth Using GPS
- Ballistic Pendulum
- Rocket Dynamics
- Video Analysis of a Collision in 2D
- Study of Oscillations and Vibrations Using the Sonic Motion Sensor
- Damped Harmonic Motion Simulation
- Falling Rod Experiment
- Rotational Dynamics
- Newton's Law of Gravitation and Kepler's Laws of Planetary Motion

Total Hours: 54

Additional Information

Is this course proposed for GCC Major or General Education Graduation requirement? If yes, indicate which requirement in the two areas provided below.

Yes

GCC Major Requirements

No Value

GCC General Education Graduation Requirements

Natural Sciences

Repeatability

Not Repeatable

Justification (if repeatable was chosen above)

No Value

Resources

Did you contact your departmental library liaison?

No

If yes, who is your departmental library liason?

No Value

Did you contact the DEIA liaison?

No

Were there any DEIA changes made to this outline?

No

If yes, in what areas were these changes made:

No Value

Will any additional resources be needed for this course? (Click all that apply)

No Value

If additional resources are needed, add a brief description and cost in the box provided.

No Value