

**STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK**



MASTER SYLLABUS

PHYS 117 PHYSICS FOUNDATIONS FOR GAMES AND MULTIMEDIA

CIP Code: 40.0801

Created by: Feng Hong
Updated by: Feng Hong

**CANINO SCHOOL OF ENGINEERING TECHNOLOGY
PHYSICS
Fall 2026**

A. **TITLE:** Physics Foundations for Games and Multimedia

B. **COURSE NUMBER:** PHYS 117

C. **CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):**

# Credit Hours per Week	4
# Lecture Hours per Week	3
# Lab Hours per Week	1
Other per Week	

D. **WRITING INTENSIVE COURSE:**

Yes	
No	X

E. **GER CATEGORY:**

Does course satisfy a GER category(ies)? If so, please select all that apply.

[1-2] Communication	
[3] Diversity: Equity, Inclusion & Social Justice	
[4] Mathematics & Quantitative Reasoning	
[5] Natural Science & Scientific Reasoning	X
[6] Humanities	
[7] Social Sciences	
[8] Arts	
[9] US History & Civic Engagement	
[10] World History & Global Awareness	
[11] World Languages	

F. **SEMESTER(S) OFFERED:**

Fall	
Spring	X
Fall and Spring	

G. **COURSE DESCRIPTION:**

This course includes systems of units, scientific method, one- & two-dimensional kinematics, Newton's laws, torques and rotational equilibrium, work, energy, linear momentum and collisions, wave and acoustics, electricity and magnetism, and optics. Emphasis is on development of laboratory and problem-solving skills including description, organization, analysis, summarization, and criticism in accordance with the scientific method. Students demonstrate understanding of core concepts such as mechanics, energy, waves, and optics relevant to interactive media and game environments.

H. PRE-REQUISITES: N/A

CO-REQUISITES: MATH 121, College Algebra or Math 123, Pre-Calculus

I. STUDENT LEARNING OUTCOMES:

Course Student Learning Outcome [SLO]	Program Student Learning Outcome [PSLO]	GER	ISLO & Subsets
a. Explore the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement, and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis	N/A	An understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of data analysis or mathematical modeling	2. Crit. Thinking
b. Apply the major principles and concepts that form the basis of the knowledge covered in the course and a command of the relevant terminology	N/A	Application of scientific data, concepts, and models in one of the natural sciences	2. Crit. Thinking
c. Demonstrate how the various topics of physics are related to everyday life	N/A	Application of scientific data, concepts, and models in one of the natural sciences	1. Communication 2. Crit. Thinking

KEY	Institutional Student Learning Outcomes [ISLO 1 – 5]
ISLO #	ISLO & Subsets
1	Communication Skills Oral [O], Written [W]
2	Critical Thinking <i>Critical Analysis [CA], Inquiry & Analysis [IA], Problem Solving [PS]</i>
3	Foundational Skills <i>Information Management [IM], Quantitative Lit./Reasoning [QTR]</i>
4	Social Responsibility <i>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</i>

J. APPLIED LEARNING COMPONENT:

Yes	X
No	

If yes, select [X] one or more of the following categories:

Non-Clinical Practicum	X	Community Service	
Internship		Civic Engagement	
Clinical Practicum		Creative Works/Senior Project	
Practicum		Research	
Service Learning		Entrepreneurship [program, class, project]	

K. TEXTS: None (SUNY OERs)**L. REFERENCES:** None**M. EQUIPMENT:**

Existing physics laboratory equipment will be used.

N. GRADING METHOD: A-F**O. SUGGESTED MEASUREMENT CRITERIA/METHODS:**

- Exams
- Quizzes
- Homework
- Labs

P. DETAILED COURSE OUTLINE:

- I. 1-Dimensional (1D) Motion
 - A. Horizontal motion with constant acceleration
 - B. Vertical Motion - Free-falling
- II. 2-Dimensional (2D) Motion
 - A. Projectile motion
 - B. Circular motion
 - C. Applications of 2D motions in animation and game development, especially for creating realistic and engaging movement
- III. Newton's Laws
 - A. Newton's first law, Newton's second law, and Newton's third law
 - B. Applications for Newton's laws
 - C. Newton's laws applied to game physics engines
- IV. Work and Energy

- A. Kinetic Energy, Gravitational Potential Energy, Mechanical Energy, Work Energy Theorem, and Conservation of Energy
 - B. Applications of Mechanical Energy in gaming and animation

- V. Linear Momentum and Collisions
 - A. Conservation of Linear Momentum in One and Two Dimensions
 - B. Momentum and Collisions in Ragdoll Physics

- VI. Rotational motion and torque
 - A. Rigid body dynamics
 - B. Angular velocity
 - C. Moment of inertia

- VII. Waves & Acoustics
 - A. Sound waves: period, frequency, amplitude, and harmonics
 - B. Resonance and standing waves
 - C. Decomposing complex sounds
 - D. How humans perceive pitch and loudness

- VIII. Electricity and Magnetism
 - A. Concepts of Electric Resistance, Electric Current, Voltage Difference, and Ohm's Law
 - B. Capacitors and Inductors
 - C. Electromagnetic Wave and Spectrum of EM Waves

- IX. Light and Optics
 - A. Nature of Light
 - B. Reflection, Refraction, and Total Internal Reflection
 - C. Image Formation by Mirrors and Lenses
 - D. Photoelectric Effect
 - E. Color theory and physics of pigments
 - F. Human color perception and limitations
 - G. Interference and Diffraction
 - H. Lasers in Media Production

- X. Relativity of time and space

Q. LABORATORY OUTLINE:

- I. 1D motion analysis: position, displacement/distance, velocity, and acceleration.
- II. 2D motion: projectile motion
- III. Rotational Motion and Rollover Lab
- IV. Simulation of Collision Lab
- V. Pendulum Lab
- VI. Wave Simulation Lab

- VII. Simple Circuit and Ohm's Law Lab
- VIII. Capacitor Lab
- IX. Reflection, Refraction, and Total Internal Reflection Lab
- X. Image Formation Lab
- XI. Light Interference Lab
- XII. Color Simulation Lab (two-week lab)

APPENDIX: Assessment Plan for General Education Requirement 2

Students will demonstrate:

1. An understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.
2. An understanding of the major principles and concepts that form the basis of the knowledge covered in the course and a command of the relevant terminology appropriate for basic discourse in the particular discipline or disciplines of the course. “

Method:

Assessment of Outcome #1 will be accomplished using a course-embedded 10-question instrument to be written by the instructors and submitted for initial approval to the GER 2 coordinator for review by the GER subcommittee of the Academic Assessment Committee.

Assessment of Outcome #2 will be course-embedded. All course (lecture and lab) outlines and syllabi of natural science approved courses will have clearly defined objectives. Virtually all of these objectives will be in some way related to outcome #2. Thus, we consider an individual student's grade on a comprehensive final exam to be an accurate measure of the achievement of outcome #2.

The Office of Institutional Effectiveness selects a random 50% sample of GER 2 designated courses to undergo assessment for the fall semester during which GER 2 is up for review (once every three years). Faculty are notified of their course selection during the previous spring semester to allow time for planning assessment activities.

Instructors are responsible for entering their measures into Taskstream by the 4th week of fall semester and entering the findings for these measures into Taskstream by the end of the week following final grade submission. **In addition, instructors must supply at least 3 student artifacts (1 from each level of proficiency: exceeded, met, not met) as samples and attach them in Taskstream. Three artifacts must be provided for both objectives.**

Instructors are responsible for submitting the Data Collection Report (below) to the GER 2 coordinator by the end of the week following final grade submission.

Once all assessment is completed by the GER 2 Coordinator, they must prepare a summary of the results to be given to the General Education Assessment Committee Chair who will forward them to the GER committee for review.

Learning Objectives:	Assessment tools:	Results/Findings:						Reflection/Use of Findings:
<p>Below are the two objectives for GER 2: Natural Sciences. Faculty members are expected to record student proficiency in all areas</p>	<p>This list represents a variety of tools commonly used to assess this SLO. Please select the tool(s) you will be using for the GER assessment. Please highlight the tool(s) you are using, and add a brief description of the tool used (e.g., final exam essay #2) in the space to the right.</p>	<p>Record the number and percentage of students achieving at the different levels for <u>each objective</u> (not each measure.) Percentages will be based on the number of students who participated in the assessment only (e.g., if your course has 10 students enroll, but only 8 take the assessment, those 8 represent the denominator.)</p>						<p>Based on these results, briefly address what changes you plan for improving student learning.</p>
<i>Students will demonstrate:</i>	# of students participating in assessment:	Exceeded		Met		Did not meet		<p><u>Please include planned changes to curriculum, teaching and assessment methods, and/or support services</u></p>
		N	%	N	%	N	%	
<p>1. An understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.</p>	Assignment	7	54%	4	31%	2	15%	
	Exam question(s)	<p>Description of tool(s): 10 questions are created and used as a tool to assess Natural Sciences Scientific Method.</p> <p>Target Score: 80% or higher = Exceeded Standard; 70 to 79% = Met Standard; 69% or less = Did not meet Standard.</p>						
	Oral presentation							
	Project (group or individual)							
	Quiz							
	Research paper							
	Student Artifact							
	Student Portfolio							
Other (Please specify): 10 questions are created to evaluate this student learning outcome.								
<i>Students will demonstrate:</i>	# of students participating in assessment:	Exceeded		Met		Did not meet		<p><u>Please include planned changes to curriculum, teaching and assessment methods, and/or support services</u></p>
		N	%	N	%	N	%	
<p>2. An understanding of the major principles and concepts that form the basis of the knowledge covered in the course and a command of the relevant terminology</p>	Assignment	7	54%	6	46%	0	0%	
	Exam question(s): Final Exam	<p>Description of tool(s): The final exam is used as a measuring tool to assess students' understanding of the major principles and concepts.</p> <p>Target Score: 80% or higher = Exceeded Standard;</p>						
	Oral presentation							
	Project (group or individual)							
	Quiz							
	Research Paper							
	Student Artifact							

Learning Objectives:	Assessment tools:	Results/Findings:						Reflection/Use of Findings:
<p>Below are the two objectives for GER 2: Natural Sciences. Faculty members are expected to record student proficiency in all areas</p>	<p>This list represents a variety of tools commonly used to assess this SLO. Please select the tool(s) you will be using for the GER assessment. Please highlight the tool(s) you are using, and add a brief description of the tool used (e.g., final exam essay #2) in the space to the right.</p>	<p>Record the number and percentage of students achieving at the different levels for <u>each objective</u> (not each measure.) Percentages will be based on the number of students who participated in the assessment only (e.g., if your course has 10 students enroll, but only 8 take the assessment, those 8 represent the denominator.)</p>						<p>Based on these results, briefly address what changes you plan for improving student learning.</p>
<p><i>Students will demonstrate:</i></p>	<p># of students participating in assessment:</p>	Exceeded		Met		Did not meet		<p><u>Please include planned changes to curriculum, teaching and assessment methods, and/or support services</u></p>
		N	%	N	%	N	%	
<p>appropriate for basic discourse in the particular discipline or disciplines of the course. “</p>	<p>Student portfolio Other (Please specify): Project presentations: Students explaining a complex concept to peers or faculty using the appropriate terminology and presentation style.</p>	<p>70 to 79% = Met Standard; 69% or less = Did not meet Standard.</p>						

GER Assessment Policies

Faculty and students will periodically be required to engage in assessment activities to ensure that the General Education learning outcomes are being met.

- GER student learning outcomes are assessed on a three year cycle through the courses designated as meeting that GER.
 - Any instructor (full-time or adjunct) teaching any course with a GER designator (online or face-to-face) may be called to participate in GER assessment activities.
 - A random sample of GER designated courses are selected by the Office of Institutional Effectiveness during the spring semester preceding the GER assessment year. If a faculty member is teaching two of the same course they have the option of choosing either section for assessment.
- **Timeline for GER Assessment:**
 - February (**Spring Semester**): Office of Institutional Effectiveness (OIE) notifies GER assessment coordinator of upcoming assessment and calls for methodology revisions (if any)
 - March 1: Methodology changes for upcoming assessment cycle must be submitted to GER Assessment Subgroup
 - Mid-April: OIE selects courses up for GER review the following fall and notifies faculty
 - 2nd week of classes (**Fall Semester**): OIE reminds faculty (and notifies new faculty) of GER assessment requirements
 - End of 4th week of classes: Faculty must enter their assessment measures of GER course SLOs into Task Stream.
 - End of 5th week of classes: Faculty update GER coordinator on progress with measure entry in Task Stream.
 - 1 week after final grade submission: Faculty must enter findings to Taskstream measures and submit Data Collection Reports to GER coordinator along with student artifacts.
 - Friday before the first week of classes (**Spring Semester**): faculty will meet to discuss GER findings and strategic plan for improving student learning.
 - March 1: GER Summary Report and GER Campus Report due to GER Assessment Subcommittee for review and recommendations.
 - March 15: GER Assessment Subcommittee presents reports and recommendations to Academic Assessment Committee
 - April 1: Academic Assessment Committee presents reports to Deans' Cabinet for inclusion in budget (if applicable.)
- **Protocol for creating a new course for GER approval:**
 - For a course to be accepted as a GER course, the GER assessment methodology must be attached to the course proposal as it moves forward to curriculum committee. GER mapping to course SLOs must be present in course proposal.
 - Course SLO's need to include the GER SLO's.
- **Protocol for Methodology Revision**
 - Faculty who wish to revise their GER methodology must submit proposed methodology to the GER committee by the fifth week of the semester before their assessment cycle begins.

- The GER committee will review and provide feedback for revision, and if necessary request a meeting with the GER coordinator. They will provide feedback within six weeks.
- Resubmission of the revised methodology must occur by the last day of the semester prior to the assessment cycle the methodology will be used in.
- If the methodology does not comply with the needs of the campus and SUNY standards, the previous methodology will be employed for the assessment cycle.

GER (General Education Requirement) 2
ASSESSMENT TEST QUESTIONS FOR PHYSICS

Science is a way of knowing. It seeks objective evidence that explains how nature works.

One of the goals of the General Education natural science component is an understanding of the methods scientists use to explore natural phenomena. Please answer the following questions based on your understanding of these methods.

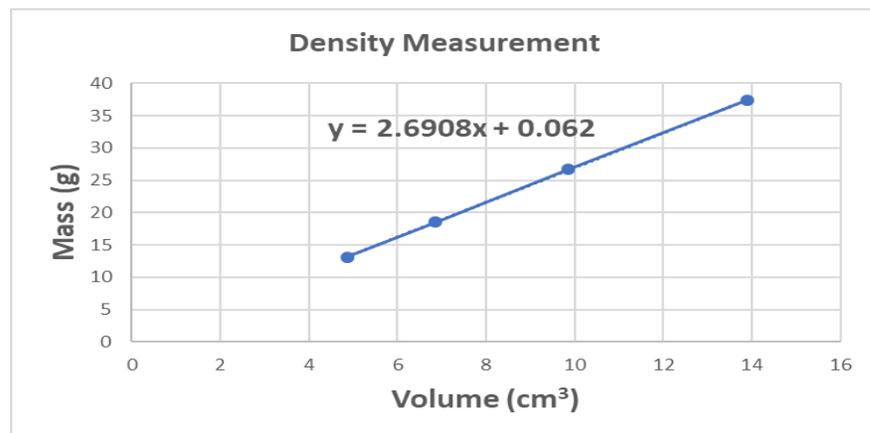
Measurement/data collection, observation, experimentation, graphing, developing hypothesis and evaluation of evidence

Question 1-2:

Density (ρ) is defined as the mass (m) of a sample divided by its volume (V): $\rho = m/V$. A student measures the mass and dimensions of four samples of aluminum metal. This student then calculates the volume using the measured dimensions of each sample and recorded the data as shown below. Using the measured mass and calculated volume, the student plots a graph of mass as a function of volume also shown below (Mass = Density * Volume)

Aluminum metal samples data

Mass (g)	13.1	18.5	26.7	37.4
Volume (cm ³)	4.86	6.86	9.85	13.9



1. What can be determined from the slope of this graph?
 - A) The total mass of the aluminum metal
 - B) the total volume of the aluminum metal
 - C) The density of Aluminum metal
 - D) All the above.

2. The density of this metal is

- A) 0.062 g/cm^3 .
- B) 2.6908 g/cm^3 .
- C) $2.6908x \text{ g/cm}^3$.
- D) $y = 2.6908x + 0.062$

For each of the following questions, choose the best answer from the choices provided.

3. Is the following equation a scientific hypothesis? **$F = m a$**

- A = Yes
- B = No

4. Which of the following is the application of physics/science?

- A) Law
- b) Theory
- C) Principle
- D) Technology

5. The most common form of the scientific method involves proposing and testing hypotheses.

A hypothesis:

- A) is an “educated guess” proposed as a tentative explanation for a specific phenomenon.
- B) is an explanatory idea that is broad in scope and supported by a large body of evidence.
- C) is a widely accepted idea about a phenomenon.
- D) is a statement about what you already know to be true.

6. Which of the following represents a typical sequence of events in scientific investigation?

- | | |
|--------------------------------------|--------------------------------------|
| 1. hypothesis/prediction | 4. conclusion |
| 2. interpretation | 5. experimentation / data collection |
| 3. observation leading to a question | |

- A) 3 – 1 – 5 – 2 – 4
- B) 1 – 5 – 3 – 2 – 4
- C) 3 – 1 – 2 – 5 – 4
- D) 1 – 5 – 2 – 3 – 4

7. The scientific method says that first you observe something, make a hypothesis of what might explain the observation, and then you test the hypothesis. Which of the following statements

follows the scientific method?

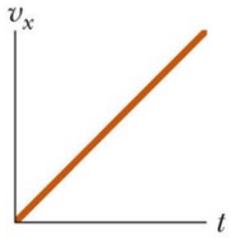
- A) Your car is driving along and the engine dies. You park it on the side of the road and walk to the nearest gas station.
 - B) Your car is driving along and the engine dies. You lift the trunk, get out the jack and change the front tire.
 - C) Your car is driving along and the engine dies. You lift the hood, wiggle the battery cables, and go in and try to restart the car.
 - D) Your car is driving along and the engine dies. You lift the hood, and observe that the radiator fluid is down so you call for help on your cell phone.
8. You go to your car and you see a puddle of fluid underneath your car where the engine is located. Which of the following statements follows the scientific method to attempt to explain this observation?
- A) You add a quart of oil, get in, and drive away
 - B) You get in and start the car. It starts so you drive away
 - C) You add some antifreeze, move the car to a new spot and see if a "puddle of fluid" appears underneath your car again.
 - D) You ask somebody to drive you home.
 - E) You read your owner's manual to see how many quarts of oil it should take, then add that many quarts of oil.
9. Four students measure the mass of an object, each using a different scale. They record their results as follows:

Student	A	B	C	D
Mass (g)	49.06	49	50	49.2

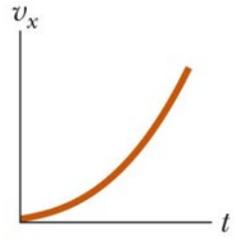
Which student used the most precise scale?

- A) A
- B) B
- C) C
- D) D

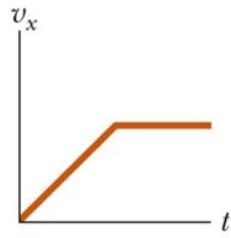
10. Show below are the velocity versus time graphs of motion of objects. For which graph is the object moving at constant acceleration?



(a)



(b)



(c)

- A) (a)
- B) (b)
- C) (c)
- D) all the above