



COURSE OUTLINE

Course Number

PHY 115

Course Title

General Physics I

Credits

4

Hours:

**lecture/Lab/Other
3/3/0**

Co- or Pre-requisite

**Prerequisite: MAT 146 with grade C or better and
One semester of high school or college physics.
Co-requisite: MAT 151**

**Implementation
sem/year**

Spring 2019

Catalog description:

The first course in a calculus-based physics sequence intended for students majoring in physics, engineering science, computer science, mathematics, and other technical areas. Topics include kinematics, dynamics, statics, energy, momentum, oscillations, gravity, as well as solid and liquid materials. The laws of physics are investigated and applied to problem solving. *3 lecture/3 laboratory hours*

Required texts/other materials:

Fundamentals of Physics, volume 1
Halliday & Resnick
John Wiley & Sons
10th Edition

Physics 115 Laboratory
Jing Huang

Scientific Calculator

Revision date:

02/13/2019

Course coordinator: (Name, telephone number, email address)

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Course Competencies/Goals

Upon successfully completing the course, the student will be able to:

1. Master basic concepts and principles. (GE Goal 3, MCCC CS Goal B)
2. Develop critical thinking and problem solving skills. (GE Goals 2, 3 & 9, MCCC CS Goal B)

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3. Properly use laboratory instruments and solve real world problems. (GE Goal 2, 3, 4, MCCC CS Goal B)
4. Carry out teamwork. (MCCC CS Goal F)
5. Apply calculus in solving problems. (MCCC CS Goal B, GE Goal 2)
6. conduct literature search, analysis, and presentation (GE Goal 1, 4 , MCCC CS Goal A, D, E)
7. Understand cultural, historical, and ethical issues through solving relevant problems. (GE Goals 7, 9; MCCC CS Goals G)

Course-specific General Education Knowledge Goals and Core Skills.

General Education Knowledge Goals

Goal 1. Communication. Students will communicate effectively in both speech and writing.

Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Goal 7. History. Students will understand historical events and movements in World, Western, non-Western or American societies and assess their subsequent significance.

Goal 9. Ethical Reasoning and Action. Students will understand ethical issues and situations.

MCCC Core Skills

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

Goal B. Critical thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.

Goal D. Information Literacy. Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems, and communicate with others.

Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

Goal G. Intra-Cultural and Inter-Cultural Responsibility. Students will demonstrate an awareness of the responsibilities of intelligent citizenship in a diverse and pluralistic society, and will demonstrate cultural, global, and environmental awareness.

Units of study in detail.

General Learning Objective

The student will be able to...

- understand basic physics concepts (**Course Competencies 1, 5; Gen Ed Goal 3**)
- master the laws in physics (**Course Competencies 2, 5; Gen Ed Goal 3**)
- develop problem-solving skills (**Course Competencies 3, 4, 5, 6; Gen Ed Goal 3, 4; Core Skill B**)
- develop critical-thinking skills (**Course Competencies 1, 2, 3, 4, 6, 7; Gen Ed Goal 3; Core Skill B**)

Unit I Kinematics

Learning Objectives

The student will be able to...

- understand measurements, units, and significant figures (CG 1, CG7)
- apply trigonometry and basic calculus in analyzing one-, two-, and three-dimensional motions. (CG1, CG3, CG 5)
- improve problem solving skills by reading word problems and apply basic concepts. (CG2)
- solve problems involving vectors. (CG2)
- solve problems in laboratory. (CG3 and CG4)

Unit II Dynamics and Conservation Laws

Learning Objectives

The student will be able to...

- Understand gravity, tension, normal force, and friction (CG1)
- Understand and apply Newton's laws of motion. (CG1, CG2)
- solve problems using work, energy, and conservation of energy (CG5, CG2, and CG7)
- solve problems using momentum, impulse, and conservation of momentum. (CG1, CG2, CG 5, and CG 7)

Unit III **Circular Motion and Rotational Motion**

Learning Objectives

The student will be able to...

- reinforce knowledge on vector in learning circular and rotational motions. (CG1)
- reinforce problem solving in two- and three-dimensional motions. (CG2 and CG2)
- understand the basic concepts involved in circular motion and rotational motion (CG1)
- relate the angular motion to linear motion (CG1)
- reinforce dynamic through solving problems using torque. (CG2, CG5, and CG7)
- understand the important concept of equilibrium. (CG1, CG2, CG 7)
- Research and presentation on alternative energy (CG1, CG4, CG6, and CG7)
- solve problems in the laboratory (CG3, CG5)

Unit IV Gravitation

Learning Objectives

The student will be able to...

- Qualitatively and quantitatively understand Newton's Law of Universal Gravity (CG1)
 - Relate gravity to gravitational constant employed in kinematics. (CG2, CG5)
 - relate gravity to circular motion (CG2, CG5, CG6)

Unit V **Solids and Fluids**

Learning Objectives

The student will be able to...

- understand states of matter (CG1)
- solve problems with regard to properties of solids and fluids (CG1, CG3, and CG4)
- apply the physics principals in understanding the environment. (CG6)
- apply physics knowledge in environmental protection (CG7)
- apply physics knowledge in preserving natural resources (CG7)

Unit VI **Oscillations and Waves**

Learning Objectives

The student will be able to...

- understand simple harmonic motion and resonance (CG1)
- quantitatively understand the wave properties, frequency, wavelength, and speed (CG3, CG4, CG5)
- understand standing waves (CG1, CG3, CG4)
- understand sound waves, intensity, speed (CG1, CG3, CG4)
- understand Doppler effect (CG1, CG2, CG3, CG4, CG5)

Laboratory experiments:

1. Measurements and Math overview

- Go over algebra and calculus required through problem solving (CG2)
- Establish laboratory safety rules. (CG3)
- Learn to use balances, Vernier caliper, stop watch, and gated timer to measure mass, length, and time.(CG3)
- Learn to record data and process data with proper significant digits (CG2)
- Learn about the components of lab report. (CG5)

2. Velocity and acceleration

- Measure velocity with rulers and timer (CG3)
- Learn to use GLX (CG3)
- Learn to use Data Studio software (CG3)
- Learn to use motion sensor to measure velocity and acceleration (CG3, CG2)
- Learn to perform numerical differentiation using Excel. (CG3)
- Learn to use calculus to calculate velocity and acceleration (CG5)

3. Free fall & force table

- Study the free-fall motion with gated timer (CG3)
- Learn to graph with Excel (CG2, CG3)
- Learn to perform linear regression in Excel (CG2)
- Learn to use force table to study vector addition and subtraction (CG3)
- Learn to apply trigonometry in vector analysis (CG3)

4. Street crossing & projectile motion

- Numerical simulation of pedestrian street crossing with a car approaching (CG2)
- Measurements of projectile motions (CG2)
- Apply trigonometry in vector analysis (CG3)
- Apply calculus in analyzing the acceleration (CG5)

5. Atwood machine

- Measure the acceleration of Atwood machine and compare with theoretical value (CG1, CG3)
- Analyze the motion with constant acceleration using calculus (CG3)

6. Friction

- Measure the static friction coefficient by gradually raising the slope (CG3, CG4)
- Use Tiltmeter cell phone app to measure the angle of a slope (CG3)
- Use trigonometry for force analysis (CG3)

7. Sustainable energy research & presentation

- Research different types of sustainable energy and application. (CG6, CG7)
- Learn to present (CG7)
- Learn to be good audience (CG2, CG4)

8. Conservation of energy, pendulum

- Measure the horizontal and vertical displacement of a projectile motion (CG3)
- Calculate the two dimensional motion (CG2)

9. Impulse momentum theorem

- Learn to use motion sensor to record velocity data of an object on a track (CG3)
- Calculate the Momentum using Excel (CG2)
- Apply calculus in calculating velocity and momentum (CG5)
- Apply calculus in calculating impulse (CG5)

10. Rotational motion

- Measure linear motion (CG3)
- Numerical differentiation and integration using Excel (CG2, CG3)
- Calculate angular motion using the recorded data of linear motion (CG2)
- Study the rotational motion dynamics (CG3, CG2)

11. Rotational equilibrium

- Learn about torque with real object (CG1, CG3)
- Measure the location and magnitude of force acting on a rigid body (CG3, CG4)

12. Archimedes' principle
 - Measure mass (CG3)
 - Measure apparent mass (CG2)
 - Calculate the density of the material (CG2, CG4)

13. Simple harmonic motion
 - Learn to measure the period of pendulum with gated timer (CG1, CG3)
 - Learn to measure the spring constant using static setup (CG1, CG3)
 - Learn to measure the spring constant using dynamic setup of oscillating spring (CG2, CG4)
 - Apply calculus in calculating the period of the motion. (CG2, CG5)

14. Standing waves
 - Measure resonance and standing wave using air column using tuning forks (CG1, CG2, CG4)
 - Record sound intensity using sensors and GLX (CG3)

15. Sound
 - Learn to use sound sensor (CG2, CG3)
 - Learn to study sound intensity (CG3)

Evaluation of student learning:

Students are expected to attend all lecture and laboratory sessions. The evaluation will be based on performance and participation. The laboratory score includes the laboratory reports and laboratory tests. The participation score is based on attendance and classroom contribution.

Course Component	Weight	Notes
Unit tests	45%	There is no makeup test. Drop one lowest score.
Final, cumulative	15%	
Laboratories	30%	There is no makeup lab. Drop one lowest score.
Lecture Participation	-5% - 5%	
Laboratory Participation	-5% - 5%	

A student who has special needs because of a documented disability is entitled to receive accommodations (Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973). Students are to submit the accommodation form to the instructor at the start of the semester. For more information, contact Arlene Stinson, Director of the Center for Inclusion, Transition and Accessibility, LB 217, 570-3525, stinsona@mccc.edu

Academic Integrity Statement: [Include a statement affirming the college's Academic Integrity policy and any specific implications for the course. See <http://mlink.mccc.edu/omb/OMB210.pdf>]

Mercer County Community College is committed to academic integrity – the honest, fair and continuing pursuit of knowledge, free from fraud or deception.

- Students should never:
 - Knowingly represent the work of others as their own
 - Knowingly represent previously completed academic work as current
 - Fabricate data to support academic work
 - Use or obtain unauthorized assistance in the execution of any academic work
 - Give fraudulent assistance to other students

- Unethically use technological means to gain academic advantages

Violators of the above actions will be penalized. For a single violation the faculty member will determine the course of action. This may include, assigning a lower grade on the assignment, lowering the course grade, failing the student, or another penalty that is appropriate to the violation. The student will be reported to the Academic Integrity Committee, who may impose other penalties for a second (or later) violation. The student has right to a hearing and also to appeal any decisions. These rights are outlined in the student handbook.