MERCER COUNTY COMMUNITY COLLEGE
COURSE OUTLINE
Revised Spring 2008

PHY 108 Course Number	**UNIVERSITY PHYSICS I** Course Title
Science and Health Professions Division	**15 Weeks** Length of Semester

3	**2**	**3**
Credits	Class Hours	Lab Hours

Text: Title: **Fundamentals of Physics** Extended
Author: Halliday & Resnick
Publisher: John Wiley & Sons
Edition: 8th

Catalog Description:

The second course in a four-semester calculus-based sequence. Covers rotation motion, angular momentum, and conservation of angular momentum, statics, simple harmonic motion, waves, gravitation, fluid pressure, and thermodynamics.

Prerequisites: PHY 107, MAT 151
Co requisite: MAT 152
Reading level: High
Writing level: High

General Objectives:

I. The student will demonstrate an understanding, including learn classical physics. Topics will be covered in mechanics, sound, heat and thermodynamics and the history of the development of Physics as an experimental, mathematical approach to explain natural phenomena. They will discover that physics is still a dynamic growing subject.

II. The student will be prepared to take another physics course that parallels those given in most engineering and physical science curricula at senior engineering college and universities.

III. The student will demonstrate an understanding that physics is not a course that lend to memorization but is a course in scientific logic. He is expected to demonstrate this in solving physics problems using mathematics logic and method.

IV. The students will be able to learn to solve physics problems by applying mathematical logic and methods to prove natural laws of physics and definitions.

Specific Objectives:

Unit I: Rotation Motion (4 weeks)

I. The student will be able to realize that there is a parallel concept between linear motion and rotary motion. By replacing velocity, acceleration, mass, etc., with rotation symbols and their dimensions in radians, he will be able to solve problems using the following formula:

Linear Motion	Rotation Motion
$v_f = v_o + at$	$\omega_f = \omega_o + \alpha t$
$x = \left(\frac{v_o + v_f}{2} \right) \times t$	$\theta = \left(\frac{\omega_o + \omega_f}{2} \right) \times t$
$x = v_o t + 1/2 a t^2$	$\theta = \omega_o t + 1/2 \alpha t^2$
$v_f{}^2 = v_o{}^2 + 2ax$	$\omega_f{}^2 = \omega_o{}^2 + 2\alpha\theta$

II. The parallel dimensions for linear an angular rotations are as follows:

	LINEAR METRIC	ROTATIONS
Distance:	x = meters	θ = radians
Velocity:	v = m/sec	ω = rad/sec
Acceleration:	a = m/sec^2	α = rad/sec^2
Mass:	M = kilograms	I = kg-m^2
Force/Torque:	F = newtons	τ = Newton-meter

III. The student will be able to learn the definition for rotational velocity and acceleration from the concept of limit and derivative calculus.

IV. The laws of conservation of rotary energy and rotary momentum will be learned. Problems dealing with these concepts will be solved.

V. The student will be able to learn the integral method of finding the moment of inertia. With the parallel-axia theorem, the student should be able to deal with these concepts in solving problems of rotational torque, energy and power and moment of inertia.

Unit I Test should be given at this time.

Unit II: <u>Equilibrium of Rigid Body, Simple Harmonic Motion and Gravitation</u> (4 weeks)

I. With the concept of center of gravity and the concept of torque, and the formula:

$$F_x = 0,\ F_y = 0,\ F_z = 0;\ \text{and Torque} = 0$$

The student will be able to solve equilibrium problems (ladder, bridge, and crane boom, etc.)

II. The student will be introduced to the concept of simple harmonic oscillatory motion by the use of a simple differential equation. He will be able to solve problems dealing with this concept. The types of problems are vertical and horizontal spring motion: compound and simple torsional pendulums.

III. The student will be able to solve problems using Newton's Law of Gravitation dealing with this concept. The types of problems are vertical and horizontal spring motion: compound and simple torsional pendulums.

IV. The Cavendish experiment will be investigated by the student.

Unit II Test should be given at this point.

Unit III. <u>Fluid Mechanics, Wave Mechanics and Sound Waves</u>

I. The student will be able to learn the definitions of fluid, streamline and ideal fluid.
II. The student will be able to learn to solve problems dealing with concepts of the Equation of Continuity and Bernoulli's equation.
III. The student will be able to learn the two types of waves (transverse and longitudinal) and will be able to find the velocity of the waves.
IV. The ideal of superposition, resonance of waves and standing waves are to be learned by the student. He should be able to solve problems dealing with these concepts.
V. The student will be able to learn about the phenomena of audible, ultrasonic and infrasonic waves, beats, and Doppler effects of sounds. He will learn how to solve problems dealing with these concepts.

Unit III Test should be given at this time.

Unit IV. Temperature, Heat and Thermodynamic Laws (4 weeks)

I. The student will be able to learn the Zeroth Law and its applications to four different temperature scales (Fahrenheit, Centigrade, Kelvin, and Rankin scale). He will learn how to convert from one temperature scale to another.

II. The student will be able to learn how to do thermal expansion problems (linear, area and volume type).

III. The student will be able to learn First and Second Laws of Thermodynamics and how to solve problems using these concepts. The second law will be learned in its differential form.

IV. The student will be able to learn Carnot cycle as a theoretical engine and refrigerator and how they apply to the present day engines (internal combustion, steam and jet engines).

V. The student will be able to learn that heat is a form of energy. Using the concept of conservation of energy, he will be able to solve problems of heat equilibrium in a close system and its dimension – calories and BTU.

VI. The student will be able to learn the three stages of matter. Kinetic Theory of Gases, the heat of fusion and heat of vaporization. Using these concepts he will learn to solve thermal equilibrium problems.

VII. The student will be able to learn the three methods of transferring heat (conduction, connective, and radiation) and be able to solve problems dealing with these concepts.

Unit IV Test should be given at this time.

Textbook Assignments: Halliday & Resnick, 8th Edition

Unit 1 -	Chapters 10 and 11
Unit 2 -	Chapters 12, 13
Unit 3 -	Chapters 14, 15, 16, and 17
Unit 4 -	Chapters 18, 19, and 20

Experiments:

General Objectives:

I. The student will be able to learn how to write a lab report. He will be able to collect data in the proper manner.

II. The student will be able to learn how to draw graphs and how to use slope-intercept method to analyze data.

III. The student will be able to learn how to use a Techitron computer to analyze data.

IV. The student will be able to learn how to write conclusions and make error analysis of his experimental results.

V. The student will be able to learn to use the micrometer and vernier caliper in collecting his data.

Specific Objectives (Experiments):

I. Air Track and Free Fall Apparatus

a.) The Student will be able to learn how to write a lab report.
b.) He will be able to learn the value of "g" (two different ways) from a demonstration experiment.
c.) The student will be able to learn the proper way of blotting and analyzing a graph.

II. Atwood's Machine

a.) The student will be able to learn to analyze a free body diagram experimentally.
b.) The student will be able to plot a graph and analyze the graph to find the value of "g".

III. Linear Momentum

a.) The student will be able to prove the Law of Conservation of momentum.
b.) The student will be able to learn how to apply the Law of Conservation of energy in order to find the velocity of particles before and after impact.

IV. Rotation

a.) The student will be able to learn how to find the value of "moment of inertia" of a rotating body through experimental and mathematical methods.

V. Conical Pendulum

a.) The student will be able to learn how to find the values of rotary velocity using experimental and mathematical methods.

VI. Cavendish Experiment

a.) The movie "Universal Gravitation" will be shown before the experiment.
b.) The student will be able to learn how to find the Universal Constant "G".
c.) The student will be able to learn how to program formula $F = \frac{GM_1M_2}{D^2}$ for "G"

VII. Rigid Body

a.) The student will be able to learn how to find the center of gravity by geometrical means.
b.) The student will prove, within experimental error, that the conditions of static equilibrium are:

$F_x = 0$ $F_y = 0$ and $J = 0$

VIII. The Crane Boom

a.) The student will be able to prove the condition for static equilibrium. By using geometrical and graphical methods, he will show that Force diagrams will close.
b.) The student will be able to find the tension and compression force exerted on the boom by placing different weights on the boom and applying the condition for static equilibrium.

IX. Simple Harmonic Motion

a.) The student will be able to learn how to find the spring constant by applying Hooke's Law.
b.) The student will be able to learn a second method to determine the spring constant by using the principle of S.H.M.
c.) The student will be able to determine the value of "g" by using a simple pendulum.

X. Hydrostatic

a.) The student will be able to learn how to prove Archimedes' principle in this experiment.
b.) The student will be able to determine the specific gravity of solid and liquid by applying the "principle of Hydrostatics".

XI. Surface Tension

a.) The student will be able to learn how to determine the Surface Tension of water and alcohol for different temperatures.

XII. Sound and Standing Wave

a.) The student will be able to learn how to find the velocity of sound in air by using a reasonable tube.
b.) The student will determine the frequency of a spring vibration by creating a standing wave in a string.

XIII. Specific Heat

a.) Using the principle of calorimetry, the student will determine the specific heat of different metals.

XIV. Linear Expansion

a.) By using the Linear Expansion Apparatus, the student will find the coefficient of linear expansion of different rods.

XV. Mechanical Equivalent of Heat

a.) By using the conservation of energy theorem in this experiment, the student will be able to learn how to determine the "Joules constant, 4.19 joule/cal".

XVI. Heat of Fusion and Vaporization of Water

a.) The student will be able to learn how to determine the value of Heat of Fusion and Vaporization of Water by using the method of calorimetry.

Experiments for Unit 1 are:

I.	Free Fall	3 Hours
II.	Atwood's Machine	3 Hours
III.	Linear Momentum	3 Hours
IV.	Vectors	3 Hours

Experiments for Unit 2 are:

V.	Conical Pendulum	3 Hours
VI.	Cavendish's Experiment	3 Hours
VII.	Inertia	3 Hours
VIII.	Rigid Body	3 Hours
IX.	Simple Harmonic Motion	3 Hours

Experiments for Unit 3 are:

X.	Hydrostatics	3 Hours
XI.	Simple Harmonic Motion	3 Hours
XII.	Sound and Standing Waves	3 Hours

Experiments for Unit 4 are:

XIII.	Specific Heat and Linear Expansions	3 Hours
XIV.	Young's Modulus	3 Hours
XV.	Mech. Equivalent of Heat	3 Hours

GRADING:

Unit tests	45%
Homework	15%
Laboratory	20%
Final Test	20%

Films in our Media Center which can be used in the course are:

1. Periodic Motion
2. Simple Waves
3. Universal Gravitation

Computer disks on Physics are available to the student in the library. They are to be viewed on library computers.

Disk B3
PHY107CO

PHY 108 – UNIVERSITY PHYSICS I

ASSESSMENT

Homework: The student should read each assigned Chapter carefully before he or she comes to class. The assignments will be collected each week and a grade will be based on 10 of the 15 highest grades. Late homework will not be accepted.

TESTS: There will be 3 Unit Tests during the semester. The final exam will consist of material on the 4th Unit only. There will be no makeup tests.

GRADING: Three Unit tests each for 45% of the final grade.
Laboratory Guide for 20% of the final grade.
Homework Assignments for 15% of the final grade.
Final Exam for 20% of the final grade.

PERCENT	GRADE	PASS/FAIL	QPA
93 - 100	A	PASS	4.0
90 - 92	A-	PASS	3.7
87 - 89	B+	PASS	3.4
83 - 86	B	PASS	3.0
80 - 82	B-	PASS	2.7
77 - 79	C+	PASS	2.4
70 - 76	C	PASS	2.0
60 - 69	D	NO TRANSFER	1.0
Below 60	F	FAIL	0.0