THREE RIVERS COMMUNITY COLLEGE
COURSE OUTLINE

Course Number/Title: PHY 114 Mechanics

Lecture 3 hrs Laboratory 2 hrs Credit 4 hrs Contact 5 hrs

Course Description: This course deals with the fundamental principles of classical mechanics. Topics covered include vectors, kinematics, translational and rotational equilibrium, torque, Newton's laws of motion, gravitation, work, power, energy, impulse, momentum and rotational motion.

Method: Lecture/demonstration/computer simulation/problem solving. Lab experiments performed and analyzed by students.

Text: College Physics, Wilson and Buffa7th ed. Prentice-Hall Publishers; Departmental Lab Experiment Book for Mechanics.

Prerequisites: High School Algebra or MATH 095 Co-Requisites: MATH 137

COURSE TOPICS/CONTENT

	HOURS
1. MEASUREMENT Metric and English Systems Dimensional Analysis Math/Trig Review if Needed	4
2. VECTORS Vector Components Vector Addition	4
3. UNIFORM MOTION Translational Motion Free Fall Projectile Motion	8
4. NEWTON'S LAWS OF MOTION Forces Mass vs. Weight Law of Inertia - Equilibrium with Concurrent Forces Friction Action - Reaction	10
5. TORQUE AND ROTATIONAL EQUILIBRIUM Center of Gravity Equilibrium with Non-Concurrent Forces	4
6. POWER - WORK - ENERGY Work - Energy Theorem Kinetic Energy and Gravitational Potential Energy	6
7. IMPULSE AND MOMENTUM Conservation of Momentum Elastic and Inelastic Collisions	3
8. CIRCULAR MOTION Centripetal Acceleration and Force Newton's Law of Gravitation Moment of Inertia Angular Momentum and its Conservation	6
9. Application of Mechanics to Technology	
TOTAL HOURS	45

LAB EXPERIMENTS

		HOURS
1.	Measurement	2
2.	Graphing	2
3.	Vectors	2
4.	Velocity in One Dimension	2
5.	Projectiles - Spring Gun	2
6.	Newton's Second Law - Air Track	2
7.	Newton's Second Law - Atwood's Machine	
8.	Friction	
9.	Force Equilibrium (The Bird on the Wire)	
10.	Static Moment Equilibrium	
11.	Energy Conservation (Freefall)	2
12.	Momentum Conservation	2
13.	Rotational Motion	2
14.	Rotational Kinetic Energy	2

Additional Laboratory Experiments

1.	The Baseball Lab (Projectiles)	1
2.	Energy Conservation - The Pendulum	1

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Continuation of PHY 114 Mechanics

The student will be able to:

* Use the SI system of measurements in the solution of physics problems.
* Perform unit conversions and cancel units correctly during computations.
* Round measurements, using the concepts of accuracy and precision.
* Solve right triangles using the Pythagorean theorem and trigonometry.
* Draw vectors and find their components using trig.
* Add vectors graphically and by using components.
* Identify in a one dimensional kinematics problem the known quantities and the unknown, choose the correct equation to solve for the unknown, and perform the algebraic manipulations needed to solve the equation.
* Solve problems involving free fall in one dimension and basic projectile problems.
* Draw a free body diagram, and state the cause of each of the forces.
* Resolve the forces of the free body diagram into components along given coordinate axes.
* Calculate mass from weight and the reverse in both SI and English units.
* Apply the first condition of equilibrium and solve the resultant equations for the unknowns.
* Find the resultant force on an object, and apply Newton's second law.
* Calculate the friction force for an object from the coefficient and the normal force.
* Calculate the work done on an object and relate it to the change in kinetic energy.
* Apply the conservation of mechanical energy (KE and GPE) to solve for initial or final speeds, or change in height.
* Apply the conservation of energy to calculate work done by friction.
* Apply the impulse-momentum equation to impact problems.
* Use momentum conservation to solve one-dimensional collision and explosion type problems.
* Compute angular velocity and acceleration in degree, radian and revolution units.
* Use the equations of circular motion to calculate initial or final angular velocities, angular acceleration or displacement.
* Calculate tangential velocity and acceleration from the angular quantities.
* Calculate centripetal acceleration and centripetal force, and apply the concepts to familiar situations (e.g., cars going around curves, twirling a yoyo on a string).
* Explain the source of "centrifugal force".
* Calculate torque on a beam subjected to more than one force.
* Apply the second condition of equilibrium to solve problems with nonconcurrent forces.
* Given moment of inertia, calculate angular acceleration from net torque.
* Given moment of inertia, calculate rotational kinetic energy.
* Use energy conservation to predict which of two same-radius objects will reach the bottom of an incline first.
* Given moment of inertia, calculate angular momentum.
* Use the conservation of angular momentum to explain demonstrations using rotating table, hand weights, and bicycle wheel.

The student will be able to do the following:

1. Read and follow written instruction.

2. Assemble and use lab equipment peculiar to mechanics, including but not limited to force tables, air tracks, rotational motion apparatus and various computer-interfaced sensors (photogates, “smart pulleys”, motion sensors, laser switches, etc.) as well as video motion-analysis tools.

3. Collect data in an organized fashion, noting precision of measurement and unit labels.

4. Analyze data by creating graphs (by hand and by computer, with slope and intercept, if needed) and by correctly inserting data into equations.

5. State results to the correct accuracy.

6. Calculate % error, where applicable.

7. Explain sources of error in an experiment based on the limitations of the equipment used.

8. Draw conclusions by relating their results to the appropriate physics principles.