Three Rivers Community College
PHY K114 Mechanics
Course Outline
Fall 2010

Credit Hours: 4 **August 26-December 16, 2010**
Lecture: Mon & Wed at 10:00-11:45 AM **Lab: 1.5 hours on Mon *or* Wed at 1-2:30 PM**

Instructor	eMail Addresses	Phone	Office Hours
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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.
Lecture Textbook (required): College Physics, 7th edition, by Wilson, Buffa and Lou
Lab Manual (required): Departmental Lab Experiment Book for Mechanics
Graphing Calculator (required): same as Precalculus course (TI-83, TI-84, TI-89 or TI-Nspire)
Prerequisite: High school algebra or MATH 095 **Co-requisite:** MATH 137
Vista blackboard: http://my.commnet.edu/ for course information and communication
Homework: Homework will be assigned, and is due at Monday's lecture. *Ongoing practice is an effective way to learn the material and prepare for the tests.* The total homework points are adjusted to be worth 10% of your total grade.
Lab Reports: You work with lab partners in the lab, but you must each prepare your own lab report, due at the beginning of the next lab period. Unexcused late lab reports will have 2 pts per week deducted (2 pts if turned in during the first week after it is due, 4 pts if turned in during the 2nd week, etc.). Each of the 13 lab reports is worth 15 points. The lab reports contribute a total of 195 points to your total grade.
Attendance: Attendance will be recorded for both lectures and labs; these will be reviewed by the Electric Boat apprenticeship administrators to ensure compliance with this program. Attendance for scheduled tests is mandatory; make-up exams will be provided to the student if approved by both the Electric Boat apprentice program administrators and the instructor.
Grading Policy: *On all tests and homework problems, use the **GECCA** format (described on page 3) to show the details of each step in solving the problem.* This supporting work demonstrates understanding, reinforces learning, and may result in partial credit if your final result is incorrect.

Grade equivalents:

A 93-100	B 83-86	C 73-76	D 63-66
A- 90-92	B- 80-82	C- 70-72	D- 60-62
B+ 87-89	C+ 77-79	D+ 67-69	F 59 or less

Grade Point Totals: ***The five exams are worth 100 points each. The lab reports are worth 195 points. The homework is worth 80 points. Your average is determined by the sum of all of these, divided by 775.***

Questions? My office hours are Monday and Wednesday at 2:30-3:30 pm and Friday at 10 am. You can also phone or email me with questions or to schedule a meeting.

Disabilities: If you have a hidden or visible disability which may require special classroom or testing modifications or special accommodations, please see me as soon as possible.

Lecture Course Outline (subject to change)

Week	Topics (chapters)
30-Aug	Metric and English Systems; Dimensional Analysis; Problem Solving (ch 1); Motion in One Dimension: Distance, Speed and Velocity (ch 2)
6-Sep	**No class Sept. 6**; Motion in One Dimension: Acceleration; Free Fall (ch 2)
13-Sep	Review for test; **Test 1 (ch 1 & 2);** Vector Components; Vector Addition; Motion in Two Dimensions (ch 3)
20-Sep	Projectile motion (ch 3)
27-Sep	Review for test; Forces; Mass vs Weight; Newton's 1st Law: Inertia (ch 4)
4-Oct	**Test 2 (ch 2 & 3);** Newton's 2nd Law: Force and acceleration; Newton's 3rd Law: Action and Reaction (ch 4)
11-Oct	Friction: Static and Kinetic (ch 4)
18-Oct	Review for test; Work Done by Constant and Variable Force (ch 5)
25-Oct	**Test 3 (ch 4);** Work-Energy Theorem; Kinetic Energy; Gravitational Potential Energy (ch 5)
1-Nov	Linear Momentum; Impulse; Conservation of Momentum (ch 6);
8-Nov	Elastic and Inelastic Collisions (ch 6) ; Review for test
15-Nov	**Test 4 (ch 5 & 6);** Angular Measure, Speed and Velocity (ch 7)
22-Nov	**No class Nov 24;** Centripetal Acceleration; Newton's Law of Gravitation; (ch 7); Torque; Rotational Equilibrium (ch 8)
29-Nov	Center of Gravity; Moment of inertia; Rotational Work & Kinetic Energy (ch 8)
6-Dec	Angular Momentum; Conservation of Angular Momentum (ch 8); Review
13-Dec	**Test 5 (ch 7 & 8)**

Laboratory Outline (subject to change)

Section 1	Section 2	Topics (chapters)
30-Aug	1-Sep	Density of a Cylinder
13-Sep	8-Sep	Graphing: The Discovery of Pi (π)
20-Sep	15-Sep	Graphing: Distance Versus Time for Rolling Objects
27-Sep	22-Sep	Vectors: The Force Table
4-Oct	29-Sep	Velocity in Two Dimensions: The Spring Gun
11-Oct	6-Oct	Projectiles: The Baseball Lab
18-Oct	13-Oct	Equilibrium: The Bird on the Wire
25-Oct	20-Oct	Newton's First Law: Friction
1-Nov	27-Oct	Energy Conservation in "Freefall"
8-Nov	3-Nov	Energy Conservation: The Pendulum
15-Nov	10-Nov	Newton's Second Law: Timer version (Air Glider)
22-Nov	17-Nov	Newton's Second Law: g by Atwood's Machine
29-Nov	24-Nov	Torque: Second Condition of Equilibrium
6-Dec	1-Dec	Review/excused/weather makeup lab section

GECCA

(*Use GECCA for all tests and homework problems*)

Given: If possible, draw a picture. List the variables and constraints provided in the problem. Identify the answer needed (your goal).

Equation: Write the equation(s) to be used to solve the problem. Include the units.

Conversions: Convert any given values needed so that all units are consistent with the equation.

Calculations: Work through the calculations

Answer: Write the final answer

Measurable Objectives

The student will be able to:

- Use the SI system of measurements in 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 trigonometry.
- 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 noncurrent 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:

- Read and follow instructions
- 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 (photo gates, “smart pulleys”, motion sensors, laser switches, etc.) as well as video motion analysis tools.
- Collect data in an organized fashion, noting precision of measurement and unit labels.
- Analyze data by creating graphs (by hand and by computer, with slope and intercept, if needed) and by correctly inserting data into equations.
- State results to the correct accuracy.
- Calculate % error, where applicable.
- Explain sources of error in an experiment based on the limitations of the equipment used.
- Draw conclusions by relating their results to the appropriate physics principles.