Grande Prairie Regional College

Department of Science

PC 1020 Mechanics
3(3-0-1.5) UT(3) Winter 1996
U of A Equivalent - Phys 102
Course Information

Calendar Description	A calculus based mechanics course. Vectors, kinematics, Newton's Law, work and energy. Potential energy, conservation of energy; conservation of linear and angular momentum. Moment of inertial, rigid body motion. Simple harmonic motion. Oscillation. Gravitation.
Prerequisite	MA 1130 or 1140 and PC 1000 *Note: Credit may be obtained in only one of PC 1010, PC 1060, PC 1410 or PC 1310.*

Instructor	Dr. Jaime P. Santiago J209, 539-2865
Lecture	TR 9:30 - 10:50 a.m.
Laboratory	M 3:00 - 5:50 p.m.
Textbook	**Physics, 4th Edition, Volume 1** by David Halliday, Robert Resnick and Kenneth S. Krane
Laboratory Manual	**Physics Laboratory Manual** by Physics Department, University of Alberta (McGraw-Hill)

Grading	Assignments	10%
	Laboratory	20%
	Midterm Examination	25%
	Final Examination	45%

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Assignments

There will be 12 problem sets in this course. Assignment problems are from the text book and will be assigned 1 week before their due dates. **Late assignments will not be accepted.**

Laboratory

Laboratory work is performed every week. There will be a lab final exam. Lab mark will be based on lab reports (80%) and the lab exam (20%).

Laboratory reports are due at the end of the period. No late reports will be accepted. Lab reports should be handwritten on black Physics Laboratory books. (Lab books may be purchased at the bookstore.) A student who misses a lab due to illness or other reasons must make up the lab at a different time. The students should make arrangements with the lab technician and the lab instructor with regards to make up labs.

Laboratory Marks and Final Grade

Students must pass the laboratory component in order to pass the course. A student who fails the lab must repeat the entire course. Students who have previously taken the course and passed the laboratory component with at least 70% may be exempted from the lab.

Midterm Examination

The midterm exam will be written during a regular class period. You will be given at least two weeks advance notice of the midterm exam.

Final Examination

Final exams are normally 3 hours long. Dates and times will be announced later by the registrar's office. Any conflicts should be reported to the registrar.

PC 1020 - Mechanics
Course Outline

Total Time: 39 one hour lectures, 1 hour for midterm exam for a total of 40 hours (14 week semester)

1.0 Measurement - Chapter 1, all sections (1 hour)

- 1.0.0 Physical quantities, standards and units. System of units. Unit conversions.
- 1.0.1 Precision and significant figures. Rounding.
- 1.0.2 Dimensional analysis.

1.1 One Dimensional Kinematics - Chapter 2, all sections except 2-8 and 2-9 (2 hours)

- 1.1.0 Particle motion
- 1.1.1 Position, displacement, average velocity, instantaneous velocity, average acceleration, instantaneous acceleration
- 1.1.2 Motion with constant acceleration. The freely-falling body.
- 1.1.3 Graphical analysis

2.0 Vectors - Chapter 3, all sections (1 hour)

- 2.0.0 Vectors and scalars
- 2.0.1 Addition of vectors
- 2.0.2 Components of a vector
- 2.0.3 Scalar and vector product

2.1 2 and 3 Dimensional Kinematics - Chapter 4, all sections except 'Relative Motion at High Speeds (2 hours)

- 2.1.0 Position, velocity and acceleration vectors -- Cartesian vectors
- 2.1.1 Motion with constant acceleration. Projectile motion.
- 2.1.2 Normal and tangential components. Circular motion, polar coordinates.
- 2.1.3 Relative motion

2.2 Force and Newton's Laws - Chapter 5, all sections (2 hours)

- 2.2.0 Classical mechanics
- 2.2.1 Force, (inertial) mass, Newton's Laws, units of force
- 2.2.2 Weight and mass
- 2.2.3 Applications of Newton's Laws. Free-body diagrams.

2.3 Particle Dynamics - Chapter 6, all sections except 6-6 and 6-9 (3 hours)

- 2.3.0 Force laws
- 2.3.1 Frictional forces
- 2.3.2 Dynamics of uniform circular motion
- 2.3.3 Equations of motion for constant and non-constant forces
- 2.3.4 Non-inertial frames. Centrifugal and Coriolis forces.

3.0 Work and Energy - Chapter 7, all sections except 7-7 (3 hours)

- 3.0.0 Work done by a constant force
- 3.0.1 Work done by a variable force
- 3.0.2 Kinetic energy and the Work-Energy Theorem
- 3.0.3 Power
- 3.0.4 Moving frames of reference

3.1 Potential Energy and Conservation of Energy - Chapter 8, all sections except 8-5, 8-7, 8-8 (3 hours)

- 3.1.0 Conservative forces
- 3.1.1 Potential energy

3.1.2 Conservative systems and the potential energy function
3.1.3 Conservation of energy in a system of particles

4.0 Systems of Particles - Chapter 9, all sections (2.5 hours)

4.0.0 Two particle and many-particle systems (center of mass of a system of particles and of solid objects)
4.0.1 Linear momentum. Conservation of linear momentum.
4.0.2 Work and energy in a system of particles
4.0.3 Systems with variable mass, the rocket equation.

4.1 Collisions - Chapter 10, all sections except 10-7 (1.5 hours)

4.1.0 Impulse and momentum
4.1.1 Collisions in one dimension
4.1.2 Collisions in two dimensions
4.1.3 Center of mass reference frame

5.0 Rotational Kinematics - Chapter 11, all sections (3 hours)

5.0.0 Pure rotation and translation of a rigid body
5.0.1 The rotational variables
5.0.2 Rotation with constant angular acceleration
5.0.3 Rotational quantities as vectors
5.0.4 Relationships between linear and angular variables -- scalar and vector forms

5.1 Rotational Dynamics - Chapter 12, all sections (4 hours)

5.1.0 Kinetic energy and rotational inertia (moment of inertia)
5.1.1 Moment of inertia of solid, rigid bodies
5.1.2 Torque, rotational dynamics of a rigid body rotating about a fixed axis
5.1.3 Combined translational and rotational motion

5.2 Angular Momentum - Chapter 13, all sections except 13-6 (3 hours)

5.2.0 Angular momentum of a particle and of a system of particles
5.2.1 Angular momentum of a rigid body rotating about a fixed axis
5.2.2 Angular momentum and velocity
5.2.3 Conservation of angular momentum
5.2.4 The spinning top

6.0 Gravitation - Chapter 16, all sections except 16-10 (5 hours)

6.0.0 Newton's Law of Universal Gravitation, the gravitational constant G
6.0.1 Gravity near the earth's surface
6.0.2 Gravitational effect of a spherical mass distribution
6.0.3 Gravitational potential energy, the gravitational field
6.0.4 Motion of planets and satellites, Kepler's Laws

7.0 Equilibrium of Rigid Bodies - Chapter 14, all sections (3 hours)

7.0.0 Conditions of equilibrium
7.0.1 Center of gravity
7.0.2 Stable, unstable and neutral equilibrium of rigid bodies in a gravitational field
7.0.3 Elasticity

Laboratory Experiments

Lab No.	Title
1	Computer Introduction
2	Bending of a Beam
3	Kinematics
4	Acceleration of Gravity
5	Dynamic Modeling I
6	Atwood's Pulley
7	Conservation of Energy
8	Moment of Inertia
9	Collision:Ramp
10	Lab Test