Grande Prairie Regional College

PC 1440: Newtonian Mechanics and Relativity

PC 1440 and 1460 are designed for students who have committed themselves to a career in which physics will play a major role. Most honours and specialization students will choose this course in the first year.

Calendar Description:

PC 1440 Newtonian Mechanics and Relativity
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A calculus based course for students majoring in the physical sciences. Newtonian mechanics, including kinematics, dynamics, conservation of momentum and energy, rotational motion and angular momentum; special relativistic kinematics and dynamics, including length contraction, time dilation, and the conservation of energy and momentum in special relativity.

Prerequisites: Pure Mathematics 30, Physics 30
Corequisites: MA 1130 or MA1140 or equivalent
Note: Credit may be obtained for only one of PC 1240 and PC 1440

Required Text: Physics for Scientists and Engineers with Modern Physics, 5th Edition (Extended Version)
ISBN 0-03-031716-9 |
Raymond A. Serway and Robert J. Beichner
Saunders College Publishing

Supplementary Reference: Spacetime Physics, 2nd Edition, 1992
Edwin F. Taylor and John Archibald Wheeler
W. H. Freeman Publishers

Grades:

Homework, quizzes, tutorials:	15%
Laboratory:	20%
Midterm Exam	20%
Final Exam	45%

Note: Students must pass the laboratory component to pass the course.

Course Outline:

1.0 Mechanics (7 weeks, Chapters 2 – 11, 14)

- 1.1. Vectors (properties, cross and dot products, components and unit vectors)
- 1.2. Kinematics in 1 and 2 Dimensions (displacements, velocity, acceleration)
- 1.3. Inertial Reference Frames
- 1.4. Newtonian Dynamics (First, Second and Third Laws)
- 1.5. Linear Momentum (Conservation, center of mass, collisions)
- 1.6. Angular Momentum and Torque
- 1.7. Energy (Kinetic Energy and Work, Potential Energy, Power)

2.0 Relativity (5 weeks, Chapter 39)

- 2.1. Failure of Newtonian Dynamics at high velocity and the constancy of the speed of light
- 2.2. Einsteinian Relativity (Simultaneity Principle, Postulates)
- 2.3. Lorentz transformations of Lengths, Time Intervals and Velocities
- 2.4. Relativistic Dynamics: Momentum and Energy

Laboratory Schedule

1. Acceleration of Gravity
2. Atwood's Pulley
3. Collision of Ball: Ramp
4. Potential-Kinetic Energy
5. Rotational Motion
6. Speed of Light
7. Bubble Chamber Photographs (must be arranged with U of A Department of Physics)
8. Lab Test