PHYS 3220: Classical Mechanics I – Fall 2011
Slot 02, Monday/Wednesday/Friday: 9:00-9:50
Lecture Room: C-4011

Instructor: Dr. Lev Tarasov, Office: C-4043, Tel: 864-2675

Textbook: Classical Mechanics by John R. Taylor, University Science Books

Other Refs: Newtonian Mechanics, A.P. French; Theoretical Mechanics: Schaum's Ouline series.

Evaluation Scheme

-four assignments, of 4 to 6 problems each, altogether worth 30% of the total mark;

-four short quizzes, graded in class by peers, worth 4% of total mark.

-one mid-term 50-min test, worth 25% of the total mark, scheduled for the last week of October;

-provision of one detailed "real life" classical mechanics example 1%.

-the 2-hour final examination, worth 40% of the total mark.

Students are permitted to bring one page (both sides) of aids to memory (formulae, etc) into the mid-term and final examinations.

Approach

There is not that much new content in this course. Instead, the focus of the course is on developing/refining problem solving skills and on solidifying student understanding of Classical Mechanics.

There are many routes to problem solving and they are not learned by memorizing what the professor did. This course is therefore structured on students learning by doing, by making mistakes, and by learning from each other. The class will often work in groups of three and active participation is critical to success in this course.

Outline

1) Review of Vector geometry and Newton's Law of Motion
   - Units
   - Scalars and Vectors
   - Vector Operations
   - Coordinate Transformations
   - Derivative of Vectors
   - Fundamental Concepts of Physics
   - Newton's Laws of Motion
   - Momentum
   - Differential Equations
   - Alternative Coordinate Systems

2) Projectile Motion and Resistance
   - Air Resistance
   - Linear Air Resistance – Horizontal and Vertical Motion
   - Quadratic Air Resistance – Horizontal and Vertical Motion
   - Terminal Velocity

3) Momentum and Angular Momentum

- Conservation of Momentum
- Rockets
- Center of Mass Systems
- Angular Momentum
- Moment of Inertia

4) Energy
   - Kinetic Energy and Work
   - Potential Energy and Conservative Forces
   - Forces as the Gradient of Potential Energy
   - Time Dependent Potential Energy
   - Energy for One-Dimensional Systems
   - Curvilinear One-Dimensional Systems
   - Central Forces
   - Energy of Interacting Particles
   - Energy of a Multiparticle System.

5) Oscillations
   - Hooke's Law
   - Simple Harmonic Motion
   - Two-Dimensional Oscillators
   - Damped Oscillations
   - Driven Damped Oscillations
   - Resonance
   - Fourier Series
   - Fourier Series Solutions for the Damped Oscillator.

6) Calculus of Variations
   - Euler-Lagrange Equation
   - Applications of the Euler-Lagrange Equations
   - More than two variable systems

7) Lagrange's Equation
   - Lagrange's Equation for Unconstrained Motion
   - Constrained Systems
   - Examples of Lagrange's Equations
   - Generalized Momenta and Ignorable Coordinates
   - Conservative Laws

8) Non-inertial Reference Frames
   - non-rotating accelerated and rotating reference frames
   - tides and Coriolis force

*** Please Note the Following ***

14.4 Information Required for Medical Certificates

14.4.1 Students who request permission to drop courses, to withdraw from University studies, to have examinations deferred or to obtain other waivers of University, departmental or course regulations based on medical grounds are required by the University to produce a note from a physician in support of their request. Such notes must be sufficiently specific to allow a proper consideration of the student's case.