Physics 5411

Classical Mechanics

Fall 2007

Location and Times: Classroom Bg.West 1.105, Mon/Wed 5:30 – 7:15 pm
Instructor: Wolfgang Rindler; e-mail: rindler@utdallas.edu
Office and Office Hours: FO2.716A Mon/Wed 4:00 – 5:00 pm
Telephone: UTD extension: 2880, Home: 972-387-9768
Teaching Assistant: Jacob Moldenhauer
Office : FO1.428, Office Hours (provisionally) M 12:30-1:30pm, F 10-12 noon

Text: We have no set text book. Students are expected to take good class notes, and embellish them at home soon after class, so as to produce their own textbook. The aim should be to make these notes as useful as possible to you before exams and in the future.
Homework: Much emphasis is placed on regular problem solving. Work is always due the Wednesday after the week when it was set. Each problem is graded A, B, or C. Collaboration, with due acknowledgment, is encouraged.
Exams: Midterm Quiz and Final.
Grade: A weighted average of homework, midterm and final. The midterm grade is not counted if it is less than the final grade.

Syllabus:

Newton's Laws; Newtonian Relativity
Systems of Particles: External Force related to Linear and Angular Momentum; Energy; Theorems on Center of Mass and Equivalent Particle. Force, Torque, Energy, and the Equivalent Particle. Pappus's Theorems. Finding centroids.
Torque and Angular Momentum about a line. Moments of Inertia; Parallel axes theorem, Orthogonal axes theorem; Finding Moments of Inertia. The Momental Ellipsoid. Applications. Products of Inertia.
Rotating Reference Frame. Coriolis and Centrifugal Forces. Foucault Pendulum. Gyroscopes. Free Motion of Rigid Bodies. Precession and Nutation.
Lagrangian Mechanics. Holonomic and nonholonomic constraints; D'Alembert's Principle and Lagrange's Equations. Lagrange Multipliers and Nonholonomic Systems. Small Oscillations; Normal Modes; Forced Oscillations.
Some Calculus of Variations. Hamilton's Principle; Hamiltonian Formalism. Maxwell Field.
Principle of Least Action. Canonical Transformations. Hamilton-Jacobi Theory. Infinitesimal canonical transformations. Liouville's Theorem. Chaos.
Poisson Brackets and Lagrange Brackets.

Course Objectives:

1. To make students understand the logical structure of Newton's theory, the interrelations of force, momentum, energy, angular momentum, torque, moments of inertia etc., and to apply them to solve problems of statics and dynamics.
2. To make students understand the logical relations between the Newtonian, Lagrangian, and Hamiltonian formulations of classical mechanics, and know when and how to apply each of these.
3. To help students become master-problem-solvers.