**Ph 610 Analytic Mechanics**

**Fall 2009**

**(http://www2.hawaii.edu/~plam/ph610/)**

**Time:** T,Th 12:00 - 1:15 p.m.

**Place:** WAT 417

**Instructor:** Prof. Pui K. Lam (956-2988), email: plam@hawaii.edu

**Office Hours:** To be arranged.

---

**Course Description:** Lagrangian and Hamiltonian formulation of classical dynamics, applications to point particle, system of particles, rigid bodies, vibrational modes, continous systems, and classical E&M fields.

**Pre-requisites:** Math 600 ( or concurrent) or Math 402.

**Texts:** "Classical Mechanics", third edition by Goldstein, Poole, and Safko, Addison Wesley

**Other References:** "Course of Theoretical Physics, Volume I : Mechanics (Course of Theoretical Physics), 3rd ed.", by Landau ,L.D and Lifshitz, E.M.

**Course Outline:**

Main Subjects: "Least Action Principle", Lagrangian and Hamiltonian Formulation of Classical Dynamics

Approach: Develope an unifying formulation for classical dynamics and use examples to illustrate fundamental concepts

Topics:

(1) Hamilton's Principle ( "Least Action Principle") , Lagrangian function, symmetry and conservation Laws - Ch. 2

(2) Applications to particle systems: non-relativistic mechanics and relativitistic mechanics (special relativity) - Ch. 3 - 7.

MIDTERM 1 AFTER CH. 6

(3) Formal theory: Legendre transformation from Lagrangian to Hamiltonian, Canonical Transformation, Hamilton-Jacobic Theory, Connection to Quantum Mechanics - Ch. 8 - 10

(4) Lagrangian and Hamilton formulation for continous systems and classical fields. Examples: Elastic Bodies and Classical E& M fields - Ch. 13

MIDTERM 2 AFTER CH. 13

(5) Presentation of term papers

** Pace ~ 3 to 4 sections per lecture

**Student Learning Outcomes:**

At the sucessful completion of this course, a student is expected to be able to

(1) explain what are Lagrangian and Hamiltonian formulations of classical dynamics, their underlying assumptions, and their connections to quantum mechanics,

(2) derive conserved quantities from symmetries of the system,

(3) apply symmetry and relativity principles to restrict the form of the Lagrangian function and Lagrangian density,

(4) solve problems similar to the examples and homework given in the course.

---

**Grading Method:**

**Course grade will be based on a pre-determined absolute scale:**

| A | B | C | D | F |
|---|---|---|---|---|
| 88 - 100 | 70 - 87 | 50 - 69 | 35 - 49 | < 35 |

**Grade percentages:** Homework (30%) Midterm 1 (20%), Midterm 2 (20%), Term paper (25%), Questions (5%)

** Every week email me 3 questions from your reading/homework by Sunday 5 p.m.

**Extra credit:** class participation (instructor's discretion; 5 % max.)

**Midterms:** Each midterm consists of two parts: in-class and take-home portions. In-class portion consists of 20 short, conceptual questions; it is closed book. The take-home portion consists of 3 word problems.

**No Final Exam. Term paper presentations on last week of class.**