PHYS 515 "CLASSICAL DYNAMICS" FALL 2009

COURSE INFORMATION

INSTRUCTOR:

Prof. Edison Liang, HBH Room 342, liang@rice.edu

TIME:

Tu Th 9:25-10:40AM

ROOM:

Geroge R. Brown Hall Rm. W 211

TEXT:

Fetter and Walecka, *Theoretical Mechanics of Particles and Continua*, Dover Paperback (2003 or latest edition)

OTHER REFERENCES:

Fetter and Walecka, *Nonlinear Mechanics: A Supplement to Theoretical Mechanics of Particles and Continua*
Goldstein, *Classical Mechanics*
Landau and Lifshitz, *Mechanics*
Marion, *Classical Dynamics of Particles and Systems*
Mathews & Walker, *Mathematical Methods of Physics*

HOMEWORK:

~ 2 problems every week

GRADER:

TBD

GRADES:

65% Homework, 10% Mid-Term, 25% Final

WEBSITE: spacibm.rice.edu/~liang/phys515

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Tentative No. Of Lectures	Topics	Text Chapter #
3	Laws of Motion and Conservation Laws, Inertial Frames, Noninertial and Rotating Frames, Galilean Transformation, Generalized Transformations, Tensor Notations	1, 2
4	Variational Principle and Lagrangian Dynamics: Constraints and Lagrange Multipliers, Hamiltonian, Symmetry and Constants of Motion, Similarity	3
2	Brief Review of Central Forces, Kepler's Problem, Scattering	1
2	Small Oscillations: Normal Modes and Eigenvalue Problems, Driven Oscillations and Resonance, Dissipation, Anharmonic Oscillations	4
2	Brief Review of Rigid Body Motions: Euler Angles, Euler Equations of Motion	5
4	Hamiltonian Dynamics: Canonical Transformations, Action-Angle Variable, Hamilton-Jacobi Theory; Poisson Brackets, Transition to Quantum Mechanics, Symmetry Principles and Contact Transformations, Liouville's Theorem	6
3	Nonlinear Dynamics and Chaos	supplement
3	Strings and Membranes: Waves, Sturm-Liouville Equations, Green Function, Perturbation Theory WKB Approximation, Boundary Value Problems	7, 8
4	Introduction to Fluid Mechanics, Sound Waves and Acoustics, Shock Waves, Dispersion and Nonlinearity	9, 10

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Examples of Math Topics covered in this course:

1. Non-Cartesian coordinates & vector calculus.
2. Complex variables including contour integration.
3. Delta-function and distributions.
4. Ordinary differential equations: eigenfunction expansions and boundary value problems.
5. Sturm-Lioville systems and special functions.
6. Matrices, tensors, eigenvectors and eigenvalues.
7. Linear partial differential equations and Green function techniques.
8. Variational methods.
9. Perturbation theory.