ANALYTICAL MECHANICS (PHY 400/500) – Spring 2014

Instructor: Prof. Bogdan Dabrowski, Physics Department, NIU. You can find me in my office (FW 216; phone: 753-6474) or in my labs FW 215 and FR 110 (phone: 753-6472) on Mondays, Tuesdays, and Wednesdays. You can also reach me on Thursdays and Fridays at Argonne National Laboratory (phone: 630-252-5541) or at email dabrowski@anl.gov.

Course meeting time and place: 3:30 to 4:45 PM on Mondays and Wednesdays at FW 227.
Office hours: on Mondays and Wednesdays from 2:00 to 3:00 PM at FW 216.

The required textbook: Louis N. Hand, Janet D. Finch *Analytical Mechanics,* (Cambridge University Press, 1998).
The optional textbook: S.T. Thornton and J.B. Marion, *Classical Dynamics of Particles and Systems*, 5th Edition (Brooks/Cole, Belmont, CA, 2004).

Course content and topics we will study (this is a tentative plan which may change if needed):
Motion of complex systems and chaos. Study of oscillating, rotating, and vibrating systems, nonlinear mechanics, mechanics of continuous media, and relativistic mechanics. Use of Fourier analysis, Green's functions, tensors, and Lagrangian and Hamiltonian formulation.

Lagrange's Equation:	Coordinates, Work, Lagrangian
Hamilton's principle:	Hamiltonian, Variational Calculus, Constraints
Oscillators:	Harmonics Oscillator, Forced Oscillator, Resonance
Central Force:	Pendulum, Two Bodies, Kepler's Orbits
Hamilton's equations:	Conservation, Dynamics, Phase Space
Vectors:	Vectors, Vector Fields, Rotations
Accelerated Systems:	Fictitious Force, Rotating Earth, Coriolis Effect
Tensors:	Tensors, Stress Tensor, Inertia Tensor
Body Motion:	Principal Axes, Euler Rotation, Spinning Tops
Small Vibrations:	Double Pendulum, Normal Modes, Strings
Non-Linear Mechanics:	Dynamic Equilibrium, Duffing Oscillator, Poincare Map, Chaos
Special Relativity:	Space-Time, Lorentz, Lorentz Transformation, Mass-Energy
Vectors:	Invariants, Relativistic Motion

There will be several problems solved in class for every chapter we study. Additional problems will be assigned as homework every week. I will collect and grade these problems the following week – there is no substitute for solving problems on your own. There will be closed-books mid-term and final exams.

The grades will be based on the total amount of points you would accumulate during the course (homework 30%, mid-term exam 30%, and final exam 40%):

A (4.00) 90 – 100%
A- (3.67) 80 – 89 %
B+ (3.33) 72 – 79%
B (3.00) 64 – 71%
B- (2.67) 56 - 63%
C+ (2.33) 48 – 55%
C (2.00) 40 – 47%
D (1.00) 32 – 39%
F (0.00) 31% or less

NIU abides by Section 504 of the Rehabilitation Act of 1973 regarding provision of reasonable accommodations for students with documented disabilities. Moreover, your academic success is of importance to me. If you have a disability that may have a negative impact on your performance in this course and you may require some type of instructional and/or examination accommodation, please contact me early in the semester so that I can provide or facilitate in providing accommodations you may need. If you have not already done so, you will need to register with the Center for Access Ability Resources (CAAR), the designated office on campus to provide services and administer exams with accommodations for students with disabilities. CAAR is located on the 4th floor of the University Health Services building (753-1303). *I look forward to talking with you to learn how I may be helpful in enhancing your academic success in this course.*