## NOTES FOR THE SECOND HOUR EXAM

The second hour exam will be held on Friday, 19 April in the usual classroom. It will be a closed note, closed book exam on which you will not be allowed to use any electronic devices.

To see copies of last year's exams, visit the website for last year (http://www.luc.edu/faculty/d-slavsk/courses/phys301/phys301 - 2012. shtml). You can check on prior years by changing the year in the URL link.

The exam will cover material from the first hour exam through Legendre series. You will not be asked to prove vector identities using Einstein summation notaion (although that will be fair game for the final). You will not be responsible for partial differential equation on this exam.

On this exam, you will be expected to :

• find the gradient, divergence, curl and Laplacian in Cartesian and other curvilinear orthogonal coordinate systems

- use the theorems of Green and Stokes
- find scale factors and unit vectors given the coordinate transformation
- obtain expressions for velocity and acceleration in different coordinate systems
- find the work done by a force; find the scalar potential from which a conservative force is derived
- derive the basic equations of celestial mechanics

• use series solutions techniques to find the appropriate recursion relation and the solution to the differential equation

• solve Legendre's differential equation, including finding the recursion relation and showing the two branches of the general solution

- determine the potential due to a series of point masses or charges using Legendre polynomials
- use generating functions to establish recursion relations for special functions
- find the Legendre series for a function defined on (-1, 1)

• use Eddington's approximation to find the moments of the radiation field, including mean intensity, flux and radiation pressure (oh, wait, that's for next spring's astrophysics class)

• write a short Mathematica program using Euler's method and loop controls to determine the numerical solution of a first order differential equation (last year's question dealt with radioactive decay)

• secure the blessings of Liberty to Ourselves and our Posterity

As I did on the first hour exam, I will provide you with a list of equations and results (and selected pages from the Mathematica document center). You should not have to memorize any equations, but you will need to recognize which equation (s) are relevant to the problem, and will know how to apply them.