ADVANCED DYNAMICS — PHY 4241/5227 HOME AND CLASS WORK – SET 6

(February 9, 2011)

Read Landau-Lifshitz §15. Due February 11.

(18) Consider the effective potential of the Kepler problem

$$U_{\rm eff}(r) = -rac{lpha}{r} + rac{L^2}{2\,\mu\,r^2} \; .$$

(A) Calculate the value r_0^{min} where $U_{\text{eff}}(r)$ has its minimum.

(B) Calculate $U_{\text{eff}}^{\min} = U_{\text{eff}}(r_0^{\min})$.

(C) Assume an energy E < 0 and calculate the values of the turning points r_{\min} and r_{\max} .

Due in class, 4 points.

(19a) Assume 0 < e < 1 for the eccentricity and transform the elliptic equation

$$\frac{p}{r} = 1 + e \, \cos(\phi) \,, \ \ p > 0 \ \ \text{into the form} \ \ \frac{x'^2}{a^2} + \frac{y'2}{b^2} = 1 \ .$$

This means, derive the definitions of x', y', major half-axis a and minor half-axis b in terms of x, y, p and e. Due in class, 4 points.

- (19b) Landau-Lifshitz §21, Problem 1. Due in class, 2 points.
- (20) Use the inertial frame of §15 of the book and plot the orbits for the four initial conditions of the table in set 5 (best in one figure). Indicate the initial positions. Due February 18 before class, 12 points.

Read Landau-Lifshitz §21. Due February 14. Read Landau-Lifshitz §22. Due February 16.