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

$$U_{\rm eff}(r) = -\frac{\alpha}{r} + \frac{L^2}{2\,\mu\,r^2}\ .$$

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

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

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

Due in class, 4 points.

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

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

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.

(20) Use the inertial frame of §15 of the book and plot the orbits for the four intial conditions of the table in set 5 (best in one figure). Indicate the initial positions. Due February 18 before class, 12 points.