PHL101 : Physics for Engineers **Instructor : Dr. Mahavir Sharma**
Tutorial-w3

1. Prove that the motion of a particle/body in a central force field remains in a plane.

2. Prove Kepler's second law (see Figure 1), that a planet going around the Sun traverses equal amount of area in a given constant time interval no matter which part of the orbit it is covering.

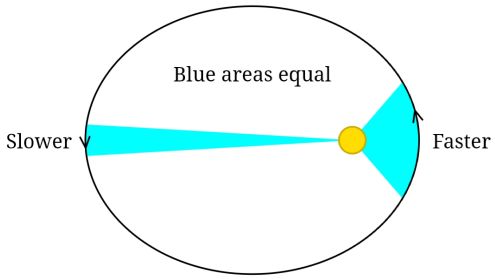

Figure 1: Kepler's second law

3. Instead of Lagrange equation, use the energy equation as was written in the lecture and using that derive the orbital equation

$$\frac{1}{r} = \frac{GMm^2}{L^2}(1 + \epsilon \cos\phi)$$

4. Kepler's third law: Begin with the elliptical orbital equation (above) and prove that the semi major axis of the orbit, a, and the time period of the orbit, T, are related as $T^2 \propto a^3$.

5. What would be the orbits in the harmonic potential $V = \frac{1}{2}kr^2$ where k is a positive constant and r the radial distance. Use the method described in the class where you find an effective potential and then analyse it. You can also formally integrate to find the trajectories.

6. What is the eccentricity, ϵ, for the Earth's orbit around the Sun. What would you say: the orbit is close to circular or more like elliptical?