Assignment 5
Central Force Motion

1. Investigate the motion of a particle repelled by a force center according to the law $F(r) = kr$. Show that the orbit can only be hyperbolic.

2. Discuss the motion of a particle in a central inverse square law force field for a superimposed force whose magnitude is inversely proportional to the cube of the distance from the particle to the force center, that is

    $$F(r) = -k/r^2 - \lambda/r^3 \quad k, \lambda > 0$$

    Show that the motion is described by a precessing ellipse. Consider the cases $\lambda < l^2/\mu$, $\lambda = l^2/\mu$, $\lambda > l^2/\mu$.

3. Find the force law for a central force field that allows a particle to move in a spiral orbit given by $r = k\theta^2$, where k is a constant.

4. An Earth satellite has a perigee of 300 km and an apogee of 3,500 km above the Earth's surface. How far is the satellite above Earth when it has rotated $90°$ around the Earth from perigee?

5. An Earth satellite has a speed of 28,070 km/hr when it is at its perigee of 220 km above the Earth's surface. Find the apogee distance, its speed at apogee and its period of revolution.