**AS5540 Space Flight Dynamics**

**Assignment No. 1**

24 January 2017

**Assignment is due: 31 January 2017 12:00 Noon**

**Please Note: The assignment should be neatly written with all steps indicated CLEARLY. They should be in A4 sheets, stapled together and submitted on time; loose sheets will not be accepted. When you run MATLAB codes and obtain results, the outputs of results must have iteration number and corresponding outputs. This should be printed and enclosed.**

1. The inertial position vector at an epoch of Meghatropiques satellite in ECI frame is given as 6837432.552 i + 1868795.099 j + 1455480.629 k m and the velocity vector is -2294.079 I + 6758.849 j + 2049.468 k m/sec. Use the routine orbit.m (Appendix D-6) of Curtis and find the position and velocity of the satellite for next 200 minutes. Describe the type of orbit that is based on your result and compute minimum altitude, maximum altitude and deduce semi-major axis, eccentricity and period of the orbit approximately. Suppose the satellite is orbiting around Moon with the similar altitude, what will be the velocity? Given: µearth = 398600 km3/s2 , Rearth = 6378.137 Km and µMoon = 4903 km3/s2 and RMoon = 1737 Km.
2. The period of Mars about Sun is 687 earth days. Find the mean distance of Mars to Sun given Earth’s distance from Sun is 149.59787 × Km. What is the orbital speed of Earth and Mars? Calculate the gravitational forces of Sun on Earth, Sun on Mars and vice versa. Given µearth = 398600 km3/s2, µmars = 42828 km3/s2.
3. A satellite is moving in an elliptical orbit with a semi-major axis, a = 12000 Km and eccentricity, e = 0.2334. Calculate the (i) specific energy (ii) specific angular momentum (iii) radial velocity, normal velocity and (iv)flight path angle for one orbit period and plot against true anomaly using your MATLAB code. Now run your code for a= 140000 Km with e = 0.95 and show how the true anomaly and flight path angle varies for this new trajectory. Compare the trajectories and list your understanding clearly.
4. A meteoroid on a hyperbolic orbit is approaching the earth and is spotted when it is 402,000 Km from the centre of the earth. At that instant, the true anomaly of the meteoroid is 150 deg and the speed is 2.23 Km/s. Find (a) eccentricity of the hyperbola, (b) altitude and speed of the meteoroid at the closest approach and (c) plot the trajectory in a plane from -to + using your MATLAB code and plot the trajectory. Also calculate the hyperbolic excess velocity.
5. An Earth orbiting satellite is having a state vector corresponding to semi-major axis = a = 25015.181 Km and eccentricity = 0.7079772. The Mean anomaly for that position is M=144.225⁰. Find the eccentric anomaly using the Newton’s iterative method given in Appendix D-11 of Curtis.