**AS5540 Space Flight Dynamics**

**Assignment No. 2**

07 February 2017

**Assignment is due: 14 February 2017 12:00 hrs.**

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. Find the Keplerian orbital elements of the satellite. Describe the type of orbit in which the satellite is planned (like prograde/retrograde orbit, why this inclination? Etc.,) and compute minimum altitude and maximum altitude and compare with your results obtained in Problem 1 of Assignment 1. Given: µearth = 398600 km3/s2 , Rearth = 6378.137 Km.
2. Calculate the local sidereal time (in degrees) at

Sriharikotta range [SHAR, India: 80⁰.1599639 E, 13⁰.724464] at 5:30 UT on 17 December 2016

Melbourne, Australia [144⁰58’ E] at 10:00 UT on 21 December 2007

Rio de Janeiro, Brazil [43⁰06’ W] at 3:00 UT on February 15, 2006

1. A tracking station at sea level whose local sidereal time is 40⁰ and latitude is 35⁰ makes the following observations of a space object.

Az = 36⁰.0 ; El = 36⁰.6; Az rate = 0⁰.59 / sec, El Rate = -0⁰.263 /sec

ρ = 988 Km and = 4.86 Km/s

What is the state vector (radius vector and velocity vector) of the object? Given: µearth = 398600 km3/s2 , Rearth = 6378.137 Km.

1. A reference frame is defined in the orbit as follows: X-axis is defined as negative of radius vector , called Yaw axis; Z-axis is defined as negative of Orbit Normal, called Pitch axis. Y-axis completes the right hand triad, called Roll axis. Given the position and velocity vectors as = 5662.1 + 6538.0 + 3269.0 Km and = -3.8856 + 5.1214 – 2.2433 Km/s, compute the transformation matrix from ECI to the Orbit Reference Frame as defined in the problem.
2. Prove that the geocentric latitude is connected to geodetic latitude by the following expression: tan φ’ = tan φ (based on reading assignment - Curtis Section 5.5)