AE-777A (Optimal Space Flight Control)

Quiz No. 5

Quiz Procedure

1. Clearly write out your solution to the quiz problems within the specified time on blank sheets of paper. (Marks will be given only for clear and complete calculation/derivation steps.)

2. Take low-resolution pictures of your solution, convert them into a single PDF file (about 1MB), and send it to me by email (ashtew@iitk.ac.in) from your registered email account.

3. The time limit will be strictly enforced, and late submissions will not be accepted for any reason.

Quiz No. 5 (Time: 60 min; Total Marks: 60)

(For Earth: $\mu = 398600.4\ \text{km}^3/\text{s}^2$)

1. The orbital period of an Earth satellite is 100 min. If the minimum radius is 6700 km, calculate:

   (a) Orbital speed at the minimum radius.

   (b) Orbital speed at the maximum radius.

   (c) Radius when the true anomaly is 270°.

   (15)

2. A spacecraft is detected by radar to be moving at a speed of 8.5 km/s around the Earth with a flight-path angle of −25°, when its radius is 11,500 km. What is the true anomaly of the spacecraft when the radar observation is taken?

   (15)

3. For an Earth orbit with a semi-major axis of 10,000 km and an eccentricity of 0.5, what are the position (radius, true anomaly) and velocity (orbital speed, flight-path angle) 30 min. after crossing the perigee? (Your answer for the angles should be correct to within 10^{-6} rad.)

   (30)

Please send your solution to me (ashtew@iitk.ac.in) before 1:00 p.m. today.