AE-777A (Optimal Space Flight Control)

Quiz No. 5

Quiz Procedure

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

(ii) 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.

(iii) Submit your solution only *once*. In case of multiple submissions, only the *earliest* one will be accepted.

(iv) The time limit will be *strictly enforced*, and late submissions will *not* be accepted.

1. Show that for a two-body orbit, both the magnitude and the direction of the orbital angular momentum are constants.

(15)

2. A spacecraft is detected by radar to be moving at a speed of 8 km/s around the Earth with a flight-path angle of $20°$, when its radius is 10,000 km. Calculate the following:

   (a) Semi-major axis of the orbit.
   (b) Orbital eccentricity.
   (c) Orbital speed at the minimum radius point.
   (d) True anomaly when the radar detection is made.

(20)

3. For an Earth orbit with a semi-major axis of 10,000 km and an eccentricity of 0.2, what is the position (radius, true anomaly) 15 min. after crossing the perigee? (Your answer for the angles should be correct to within 10^{-6} rad.)

(25)

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