AE-641A (Space Dynamics-I)

Quiz No. 2

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. The deadline includes extra ten minutes to submit your solution.

Quiz No. 2 (Time: 60 min; Total Marks: 60)

(Marks for each problem are indicated in parentheses.)

1. Write either "True" or "False" against each of the following statements:

   (a) The eccentricity vector points towards the *maximum* radius point of any two-body orbit.

   (b) The orbital angular momentum of a two-body orbit is constant in *magnitude*, but varies in *direction*.

   (c) The time period of an elliptic orbit is *independent* of its eccentricity.

   (d) The speed in any two body orbit *increases* as the radius *increases*.

   (e) The *maximum* value of the flight-path angle in a hyperbolic orbit is 90°.

   (20)

2. A spacecraft is detected by radar to be moving at a speed of 10 km/s around the Earth ($\mu = 398600.4\ \text{km}^3/\text{s}^2$) with a flight-path angle of -20° when its radius is 8000 km. Calculate each of the following :

   (a) Semi-major axis of the orbit.

   (b) Orbital eccentricity.

   (c) Minimum orbital radius.

   (d) True anomaly when the radar observation is taken.

   (20)

3. A spacecraft is in an orbit around the Earth ($\mu = 398600.4\ \text{km}^3/\text{s}^2$). When its true anomaly is 90°, the radius is observed to be 15,000 km, and when the true anomaly is 30°, the radius is 10,000 km. Calculate each of the following for the spacecraft's orbit:

   (a) Orbital parameter.

   (b) Orbital eccentricity.

   (c) Largest possible orbital radius.

   (d) Orbital period.

   (20)

Please send your solution to me (ashtew@iitk.ac.in) before 01:10 p.m. today.