

AE-641A (Space Dynamics-I)

Quiz No. 1

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. 1 (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) *Orbital mechanics* is the study of the rotational motion of the spacecraft about its centre of mass.
 - (b) The motion of a system of n -bodies in mutual gravitational attraction always takes place in a constant plane containing the barycentre.
 - (c) The barycentre of a two-body system moves in a circle.
 - (d) The net angular momentum of a rigid body about its centre of mass is independent of the velocity of the centre of mass.
 - (e) The gravitational potential of a spherical body depends upon the co-latitude angle.

(20)
2. Prove that the total energy, $T + V$, of an n -body problem is a constant.

(20)
3. Show that the straight-line (*rectilinear*) relative motion is a possible solution to the two-body problem. (*Hint*: Apply the chain rule of vector differentiation to the radius vector, and substitute into the governing equation of relative motion).

(20)

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