Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

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B.Tech.(ANE) (Sem.–6)

ELEMENTS OF SPACECRAFT ENGINEERING

Subject Code : ANE-323

M.Code : 60532

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION–A

1. Answer briefly :

a) Differentiate between missiles and launch vehicles.

b) What are different types of satellites?

c) What type of forces act on a rocket during its ascent trajectory?

d) On what parameters does ideal velocity of a rocket depend?

e) Define Kepler's three laws of planetary motion.

f) Name six parameters which define a satellite orbit.

g) Describe various phases of ascent trajectory of a rocket.

h) What do you understand by *'launch to rendezvous'* maneuver of a satellite?

i) Define an axisymmetric rigid body.

j) What are critical design parameters of a re entry trajectory?

SECTION-B

2. What are various types of missiles? With the help of neat diagrams, explain their basic features and functions.

3. What is a multi stage rocket and what are its advantages? Derive the expressions for ideal velocity of a three stage rocket. Each stage of the rocket has different mass, specific impulse and burn time.

4. With the help of neat diagram, explain various features of launch vehicle ascent trajectory and also describe dependence of orbital parameters on in-plane injection parameters.

5. Explain two important applications of earth oblateness effect in terms of regression of nodes and line of apsides.

6. With the help of neat diagram, explain trajectory geometry and re entry trajectory of a ballistic missile.

SECTION-C

7. With the help of neat diagram, explain various attitude control methods used for spinning and non spinning spacecraft.

8. With the help of neat diagram, explain inclination change maneuver and Hohmann transfer method used for a satellite.

9. (a) Prove that orbital velocity of a circular orbit of radius 'r' is given by $V = \sqrt{(\mu/r)}$, where $\mu = GM$, G = universal gravitational constant, M = mass of earth.

   (b) The period of revolution of the earth about the Sun is 365 days. The semi major axis of the earth's orbit is 1.495×10^{11} m. In turn, the semi major axis of the orbit of Mars is 2.2783×10^{11} m. Calculate the period of Mars.

NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC against the Student.