BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH **SEMESTER : I**
BRANCH: SPACE ENGINEERING AND ROCKETRY **SESSION : MO/2022**

SUBJECT: SR503 SPACE ENGINEERING AND SPACE DYNAMICS

TIME: 3:00 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Sketch a standard atmosphere model and explain the forces responsible for perturbations in the atmosphere. (BT Level: 2, CO: 4) [5]

Q.1(b) Explain why the launch environment is very dynamic. (BT Level: 1, CO: 4) [5]

Q.2(a) Prove that $\Lambda = (1-\phi)^{-1}$, where Λ: mass ratio and ϕ: propellant ratio. (BT Level: 3, CO: 2) [2]

Q.2(b) Obtain angular momentum per unit mass ($\overline{H}$) as a constant of motion. (BT Level: 3, CO: 2,3) [3]

Q.2(c) Define and explain a one-body problem as applied to the motion of an orbiting satellite. (BT Level: 3, CO: 2,3) [5]

Q.3(a) Eccentricity of an elliptical orbit (e) varies with the injection position (γ) according to the relation given below. Use this relation and linear expansions to obtain an error term for e due to error in γ, assuming no error in V. [5]

$$e = \sqrt{1 - \frac{rV^2}{\mu}\left(2 - \frac{rV^2}{\mu}\right)\cos^2\gamma}$$ where the symbols have their usual meaning.

(BT Level: 4, CO: 2)

Q.3(b) Explain the impulsive shot in terms of thrust with a mathematical approach. (BT Level: 3, CO: 3,4) [5]

Q.4(a) Explain the difference between pointing and tracking problems with a sketch. (BT Level: 3, CO: 3) [5]

Q.4(b) What are the essential characteristics of a gliding and a ballistic entry. (BT Level: 3, CO: 3) [5]

Q.5 Compare batteries with solar arrays using power and usable duration as parameters. Also supplement your answer with a sketch showing the usable region for these power sources. Can these sources be used in a definite sequence? (BT Level: 3, CO: 4) [10]

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